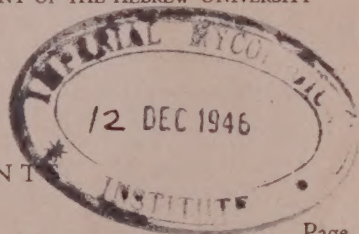


# PALESTINE JOURNAL OF BOTANY

*Jerusalem Series*

EDITED BY

THE STAFF OF THE DEPARTMENT OF BOTANY OF THE HEBREW UNIVERSITY



## CONTENT

	Page
Vegetational Transects through the Desert of Sinai. By M. ZOHARY. (With 1 map and 3 figures in the text)	57
Revision of the Oriental <i>Scrophularia</i> Species of the Herbarium of the Hebrew University. By A. EIG. (With Plate II)	79
Matériaux pour la Flore Algologique de la Palestine. I. Les Cyanophy- cées. By T. RAYSS. (Avec 5 figures dans la texte)	94
Some Interesting <i>Ustilaginales</i> New to Palestine. By T. RAYSS and E. ZWIRN	114
A New <i>Rheum</i> Species from Palestine. By NAOMI FEINBRUN. (With Plate III)	117
Summaries in Hebrew	

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VEGETATIONAL TRANSECTS THROUGH THE  
DESERT OF SINAI

By M. ZOHARY

(With 1 map and 3 figures in the text).

CONTENTS

	page
INTRODUCTION . . . . .	57
LOCATION AND TOPOGRAPHY . . . . .	58
AREA INVESTIGATED . . . . .	59
SOILS . . . . .	60
CLIMATE . . . . .	63
PHYTOGEOGRAPHICAL RELATIONS . . . . .	64
VEGETATION . . . . .	65
SUMMARY . . . . .	77
REFERENCES . . . . .	78

INTRODUCTION

The name Sinai is used here in its broad geographical sense to denote the Peninsula proper (situated between the Gulf of Suez and the Gulf of Aqaba), the Tih Plateau and the Isthmus Desert. It is one of the most extensive deserts of the Nearer East and constitutes in its flora and vegetation a connecting link between the North-African and Southwest-Asian deserts.

Though hardly accessible for botanical investigation the Sinai Peninsula has since the 19th century attracted many botanists and plant collectors who have contributed much to the knowledge of the flora of this country. Mention should be made of Rüppel, Ehrenberg and Hemprich, Bové, Schimper, Boissier, Post, Barbey, Hart, Kaiser, Kneucker, Range and many others. Recently some Egyptian botanists (Drar, Shabetai) and botanists of the Hebrew University (Eig, Zohary) collected many plants in this country which has been published in part only. Although considerable stretches remained unconsidered the flora of this country is on the whole perhaps the best known of the neighbourhood desert areas.



With the help of abundant literature and of our own material, we compiled a tentative catalogue of Sinai plants and made a phytogeographical analysis of the flora (Zohary, 1935).

While so much has been done concerning the flora, almost nothing has as yet been published on the vegetation and its ecological relations. It seems to me, therefore, that information on this subject gathered by us on a recent botanical excursion may be worthy of publication.

On the trip in the spring of 1940 by the staff of the Botanical Department of the Hebrew University<sup>1</sup> we gave full attention to the vegetational units and their distribution over certain parts of the Peninsula. Our short stay in Sinai did not enable us to do more than to record the main plant communities and establish linear transects of the vegetation encountered in route. Two of these transects were made latitudinally from the Palestinian frontier to Ismailia and to Suez and the third from Suez to Mount Sinai. The total length of these transects is about 800 km.

Since no adequate number of plant lists could be established for most of the plant communities described, the delimitation of the phytosociological units must be regarded as tentative only. Though I am fully aware of the incompleteness of the present survey I hope it will afford suggestions for future exploration in this country.

#### LOCATION AND TOPOGRAPHY

The Sinai Peninsula comprises an area of about 60,000 square/km. It may be subdivided into two major regions: (1) The Tih region consisting of the Tih Plateau and including the Isthmus, (2) The Sinai region, i.e., the southern mountainous region. The northern part of the Tih region is occupied by a broad belt of sand dunes and sand plains, partly derived from local formations and in part deep ramifications of the coastal dune systems. On the southern edge the dunes overlay a gravel plain and are strongly mobile in the eastern part and more permanent in the west.

Further south a mountain system comprising Jebel Maghara, Jiddi, Yelleg, Helal, etc., constitutes the most prominent orographical feature of Northern Sinai. The interspaces between these isolated mountains are occupied by immense plains of sandy or gravelly Hammadas. These plains gradually rise in altitude towards the Tih Plateau and attain an average height of 700 m. above S.L. The Tih Plateau is bounded on the south by Jebel Ejma and Jebel Tih. Wadi el Arish, the main water course of this part empties into the Mediterranean.

In contrast to the Tih district, the Sinai region forms a massif of

<sup>1</sup> The aim of this trip was to make a reconnaissance study in the flora, vegetation and ecology of the Deserts of Sinai and Egypt. The members of the party were Dr. M. Evenari (ecology, the organizer of the trip), Dr. N. Feinbrun (the flora and the vegetation of Egypt), Mr. G. Orshansky (assistant in ecology), Dr. I. Reichert (mycology and lichenology), Dr. T. Rayss (algology and mycology), Mr. D. Zirkin (garden plants), Mr. D. Zaitschek (applied botany), Mr. A. Grizi (assistant and chauffeur), and the author of the present paper (the flora and the vegetation of Sinai). To all these friends and colleagues and especially to Miss Feinbrun and Mr. Orshansky I wish to express my warmest thanks for the help and assistance I received from them in the field work.



rugged mountains ridges broken by rough and dry ravines. It is made up mainly of igneous rocks and partly of Nubian sandstone. It is divided into two drainage systems: one emptying into the Gulf of Suez, the other into the Gulf of Aqaba. The highest peak of this mountain system is Jebel Katherina (2641 m.). Other striking mountains are Um Shomer, Jebel Musa (Mt. Sinai), Jebel Serbal, etc. Most of them are located in the centre of the region.

In the west, this region is bounded by the great sandy plain of Qaa, while the eastern slopes are more abrupt and leave only a comparatively narrow belt between them and the Gulf of Aqaba.

#### AREA INVESTIGATED

The area surveyed on our journey comprises three transsects.

The first transsect passes along the recently laid motor car route between El Auja and Ismailia. About 10 km. W. of El Auja we passed Bir Abu Awegila situated at Wadi el Arish. Bir el Hama is another station about 70 km. E. of the last named. From here to Ismailia no stations or dwellings of any kind were met. Except for the eastern part

#### SKETCH MAP OF THE SINAI PENINSULA

The three transsects are marked by heavy lines. Auja el Hafir (at the juncture of the two latitudinal lines in the East), Ismailia, Suez and Jebel Musa (= Mt. Sinai) are the extreme points of these transsects.





(Trsc. I, segments a, b) the region along the entire route consists of shifting and permanent sand dunes as well as of sandy Hammadas, i.e. gravel plains covered here and there by a layer of sand. The altitude does not exceed 400 m. The vegetation coverage is slight but no considerable stretches of bare land are seen except on shifting dunes.

The second transect is along the Auja-Suez route. The western part of the route is the "Darb el Haj" leading to Nakhl. Kussaima and Bir Hassana are the only stations passed. This route is topographically less smooth than the Auja-Ismailia route. Stony hills, extensive sterile Hammadas, considerable patches of sandy and saline lands and above all a great net of wadis coming from Jebel Jiddi, Yelleg and Helal are the outstanding features of this region. Sand dunes are rather rare here. Vegetation is very sparse; most of the Hammada plains are bare or nearly so. The wadis, on the contrary, are abundantly vegetated, as are the hillsides near the way. In the vicinity of the above mentioned mountains, the wadis bear a so-called "Mischflora"; a considerable part of it is not typical for wadis but for the adjacent hills. A maximum altitude of 800 m. is reached in the mountain region.

The third transect is along the Suez—Jebel Musa (= Mt. Sinai) route. The localities passed are Shatt, Ayun Musa, Wadi Sudr, Wadi Wardan, Wadi Taibe, Abu Zenima, Wadi Sidri, Wadi Feiran, Wadi Mukattab, Wadi Sheikh to Mt. Sinai. In its N. part as well as S. of Abu Zenima, the route approaches the coast so that saline lands are here very typical. In its southerly direction the route crosses a slightly sloping gravel plain cut by latitudinal wadis emptying into the Red Sea while in its E. and S.E. direction it passes along Wadi Feiran and Wadi Sheikh the bed of which is mostly sandy. In general five main habitats are encountered in this route: (1) inundated or high water table salines, (2) gravel plains, (3) stony wadis and fissures, (4) broad sandy wadis, (5) Nubian Sandstone and gneiss rocks. In altitude this transect ranges from sea level to 1600 m. (foot of Mt. Sinai).

Four types of vegetation occur in this region: (1) Hydro- and halophytic vegetation, frequently very luxuriant, near wells and in moist wadis, (2) typical desert vegetation of Hammadas with a very meagre coverage, (3) vegetation of dry wadis, and (4) mountain vegetation in the south-eastern region.

In our ascent to Jebel Musa we left the Convent of St. Katherina in Wadi Sheikh and climbed the mountainside on a path known as "Sikket Saydna Musa" up to the peak. The whole slope is built up of granite rocks and there are abundant fissures and small terraces with sandy soil. Vegetation varies according to altitude, exposure, slope and constitution of rock. There are also some spots moistened by springs. Vegetation is abundant between rocks and where soil accumulates.

#### SOILS

As is well known, soil development is strongly impeded in deserts and what is considered as soil in deserts would hardly be termed so in more humid regions. Nevertheless soils play a prominent part in the desert in forming the character of vegetation. True, atmospheric moisture in drought

deserts is the paramount ecological factor, but the physical constitution of the soil conditioning absorption and retention of moisture determines the coverage and constitution of the plant communities. The following soil types were distinguished in the surveyed areas.

(i) *Hammadas*

The most characteristic soil type in the desert of the Near East is the Hammada. This term is commonly adopted to plains covered with gravel or pebble. Within the region under consideration the Hammada occupies the greatest area. The gravel cover varies in density and lithological origin. Frequently it consists of pieces of flint or hard limestone overlying a highly calcareous or gypseous subsoil.

Opinions are divergent as to the genesis of the Hammada. Some authors consider it as a soil from which the finer particles have been blown off permanently by prevailing wind storms, the lack of protective vegetation cover facilitating the deflating action of the wind. Others look upon the gravel mantle as a derivation of hill debris carried down by rainstorms and distributed then over a considerable distance.

From the point of view of plant life, Hammada is the most sterile habitat of the desert. Vegetation seldom attains a coverage of 5% of the area and often considerable tracts are completely barren. Due to smooth topography and exposure to wind, Hammadas suffer greatly from dessication. Where the Hammada is protected by even a thin sand cover, conditions become favourable for plant life, as the layer of sand increases the absorption power of the soil considerably and reduces the rate of evaporation at the same time.

Another striking feature of the Hammada areas is the occurrence of shallow wadis which break the continuity of the plains. The beds of these are covered with sand or gravel and although dry in Summer their moisture content is sufficient to support rather dense vegetation and to permit the development of certain trees.

In the midst of the typical Hammada one sometimes encounters patches of stoneless land consisting of a very puffed, powdery soil, mostly salty. No trace of vegetation is to be found here.

(ii) *Sand dunes and sand plains*

Considerable tracts of Northern Sinai are covered by sands the origin of which is not always clear. Ecologically four varieties of this soil type may be distinguished within the area investigated.

(a) Shifting sand dunes. These are met with mainly along the Auja-Ismailia route, occurring either as elongated ridges or as crescent-shaped barchans. Both kinds are altogether barren of any vegetation due to the mobility of the soil.

(b) Semistable or permanent dunes. On the western half of our route to Ismailia large tracts were found occupied by this kind of dunes. They are generally rich in vegetation.

(c) Between dune ridges more or less deep troughs occur the soil of which is not only protected against the action of storms but also contains a higher amount of moisture which filters out through the dune sides. Here rich vegetation is encountered.



(d) Sand plains. They occur in different parts of the desert especially in Northern Sinai. The development of vegetation depends on the depth of the sandlayer. A shallow sand cover overlaying Hammada encourages plant growth much more than a deep one. Patches of sandy soil occurring within depressions of the Hammada invigorate plant life within the dreary monotonous Hammadas.

(iii) *Calcareous hills*

The routes we followed in N. Sinai pass in the western side through, on or near hillsides of the aforementioned mountain system. These hillsides are covered with projecting calcareous stones and boulders. Soil formation is very meagre and as soon as soil is formed it is transported by rain storms to adjacent valleys, so that the rocky substratum dominates. Surprisingly we found this habitat much more vegetated than the Hammadas. Plants are confined mainly to fissures, crevices, chasms and interspaces between the rocks. Certain plant communities rich in perennial species, are met with here.

(iv) *Loess*

Extensive areas of loess, such as encountered in southern and eastern Palestine were not observed here. But there are numerous valleys hidden between hills of which loess is most characteristic. Along the routes this soil was observed in the "Talweg" of Jiddi, Yelleg and Helal as well as in the wadis between Kussaima and Auja el Hafir.

From the point of view of origin mention should be made of the fact that within the arid region this transported soil is confined to calm and protected places.

Analysis of this soil from the environs of Beersheba have shown that in its physical and chemical composition it is the most productive soil of the arid region. In northern Sinai it is the only soil still supporting non-irrigated winter crops, despite extremely scant rainfall (50—100 m.). These properties are likewise reflected in natural vegetation here consisting of a particular plant community with a comparatively high number of associates and in a high rate of coverage. It must, however, not be forgotten that this fertility may to a great extent be a result of the topographical conditions (wadis and depressions) to which this soil is confined.

(v) *Alluvial soils (s. s.)*

This type comprises hydromorphic soils formed in banks and beds of various non-saline water bodies. Within the area investigated we met such soils mainly in the southwestern part of Sinai (Ayun Musa, Wadi Gharandal, Wadi Feiran etc.). Such soils are everywhere under cultivation and natural hydrophytic vegetation occurs only in non-arable spots.

(vi) *Salines*

Automorphic salines conditioned by climatic factors alone are rather rare in this desert. They occur in isolated spots within the Hammada region and have already been mentioned in connection with the Hammada. Most



of the salt soils met with in our route are hydromorphous mainly formed either through inundation or through raising of the ground water table. Considerable stretches of saltlands are met with in the coastal plain along the Gulf of Suez in the belt of tidal flood and in the outlet region of the wadis. Another region of salines is formed near springs of salty and brackish water (Ayun Musa, Wadi Sudr, Bir Hassana, Kussaima, etc.). This type of saline is distinguished by the formation of numerous mounds inhabited by *Nitraria* and *Tamarix* bushes. Unfortunately no data on the degree of salinity of the various salines were collected here.

#### (vii) *Igneous rocks*

The greater part of the Southern Sinai mountains are made up of igneous rocks conspicuous for flora and vegetation. It is not the rock in itself but the higher altitude in which this habitat is situated that makes this part of Sinai more favourable for plant growth than others. From these rocks a sandy soil is derived which fills up the wadis of this region and the interstices between rocks.

#### (viii) *Nubian Sandstone*

This habitat we encountered only in the vicinity of Wadi Feiran. The rock is rather soft sandstone weathering into coarse sand. The vegetation of this sandstone was not adequately studied here.

### CLIMATE

The Sinai Peninsula may in general be conceived as a drought desert in which the amount of precipitation is the principal decisive factor in vegetation. It belongs to the Mediterranean type of desert designated by its hot and dry long summer and rather mild, but short winter. The mean temperature of the hottest month (August) in Suez attains  $29.4^{\circ}\text{C}$ , while that of the coldest month does not sink below  $14^{\circ}\text{C}$ . Contrary to certain continental deserts of Central Asia where the annual range of temperature amounts to  $50^{\circ}\text{C}$  in some districts and causes a winter and summer resting period, in Sinai the summer is the only period of rest of the year. The following figures may illustrate the climatical conditions of the Tih region (Range, 1921).

#### PRECIPITATION in mm.

	Port Said 1886—1920	Suez 1886—1920	El-Arish 1919—1920	El-Hemme 1915—1916	El-Nakhl 1907—1914 1919—1920
January	22	6	20	62	6
February	11	3	24	13	7
March	10	3	14	3	4
April	6	3	9	5	4
Mai	2	3	2	—	1
June	1	—	—	—	—
July	—	—	—	—	—
August	—	—	—	—	—
September	—	—	—	—	—
October	2	1	2	—	—
November	12	3	18	2	—
December	17	4	13	2	3
Total per annum	83	26	102	87	25

## TEMPERATURE in °C.

	Port Said 1901—1920	Suez 1919—1920	El-Arish 1907—1914	El-Hemme 1915—1916	El-Nakhl 1908—1914
January	13,4	14,2	11,4	9,8	8,7
February	14,0	15,4	12,3	12,2	10,2
March	15,8	18,3	14,7	17,8	13,6
April	18,4	21,4	17,4	18,8	17,7
Mai	21,3	24,7	20,6	23,4	21,8
June	24,1	27,8	23,1	27,9	23,4
July	25,8	29,3	24,8	27,3	24,7
August	26,4	29,4	25,6	25,5	25,5
September	25,3	27,2	24,4	25,7	23,5
October	23,3	24,6	22,2	23,0	20,8
November	19,7	20,5	17,1	18,5	14,8
December	15,2	15,6	13,0	13,5	9,7
Mean annual	20,2	22,4	18,9	20,3	17,9

For the southern mountainous region no systematic records are available, but from scattered observations it is obvious that this area enjoys much more precipitation than the northern region.

Various investigators who visited this region (Barron, Hume, Kaiser, Rüppel, Bernhardt, etc.) report heavy rains and snow during the winter months. According to Barron the winter of 1889 had 20 rain days and among them eight of heavy precipitation. All mention the torrential character of the rain which gives rise to floods filling up the wadis with enormous water streams—hence the numerous springs which are often disclosed a few feet below the bed of various valleys.

As for snow there are many observations from nearly all visitors to the mountainous region. According to Kaiser (1922) snow is very frequent in ranges above 1000 m. S.L. Higher up in the mountains the snow cover may last several months. Schimper had observed a snow cover in Jebel Katherina which lasted  $5\frac{1}{2}$  months.

Taking all the single data into consideration about the climate of the mountainous part of Sinai, the conclusion is reached that this part is much more rainier than is commonly believed. Indeed, taking the vegetation as a criterion we may presume that some of the higher mountains enjoy an annual precipitation of not less than 300 mm.

## PHYTOGEOGRAPHICAL RELATIONS

In a previous paper (Zohary, 1935) the flora of the Peninsula has been analysed in its plant-geographical elements and the results may here be briefly repeated.

(1) Phytogeographically the Peninsula constitutes a district bordering the Mediterranean, Irano-Turanian and Saharo-Sindian regions.

(2) The number of species hitherto known from the Peninsula is 942. Of these 299 belong to the Saharo-Sindian element, 118 to the Mediterranean and 98 to the Irano-Turanian element. The Saharo-Sindian element is the most widely distributed of the Peninsula, and it is the Saharo-Sindian Flora of which the most characteristical plant communities of the country are made up. On the whole the Peninsula must be considered a Saharo-Sindian territory.



(3) The Mediterranean element does not occupy a particular territory in Sinai. Scattered here and there in more favourable habitats, the Mediterranean species do not by any means express the vegetational character of the region. A considerable part of these species occur as segetal and ruderal plants, other plants are confined to hydrophytic conditions. In the higher zones of the northern mountain system some scant remnants of natural Mediterranean plant communities occur and among them plants pointing to a West Mediterranean origin.

(4) The plants of the Irano-Turanian element are likewise scattered over the Peninsula. In the mountains of the Sinai region, however, the number of Irano-Turanian plants is so considerable and dominant as to form here a more or less well defined Irano-Turanian enclave. Not only does a typical Irano-Turanian shrub vegetation appear here, but remnants of an arboreal vegetation are also scattered here and there.

(5) The Sudano-Deccanian element is represented in Sinai by 41 species. These are chiefly accumulated in the wadis and similar moist habitats and plains of the mountain region.

(6) A high proportion of the Sinaitic flora (40%) belong to bi- and pluriregional groups, i.e. to groups spread over two or more plant-geographical regions. Of these the Mediterranean-Irano-Turanian groups consists of 174 species, the Saharo-Sindian—Irano-Turanian — 49; Saharo-Sindian—Sudano-Deccanian — 42; the Saharo-Sindian—Mediterranean — 10; Eurosibiro-Boreoamerican—Mediterranean—Irano-Turanian — 23; tropical, tropico-subtropical and boreo-tropical — 80; others — 8 species.

(7) The number of endemics is 36; the greater part of these are Irano-Turanian. This number will no doubt considerably increase as investigation progresses.

#### VEGETATION (see transects I—III)

##### (a) *General remarks*

In the following an account is given of the main plant communities met with and observed along the routes described above and marked in the accompanying map. As vegetation units were continuously noted along the routes followed and their composition frequently recorded in detail, the transects enclosed herewith may illustrate the spatial distribution of the various plant communities. For the sake of accuracy the transects were subdivided into segments, each segment often consisting of a mosaic of communities: the dominant plant community (open figures) and the locally limited vegetation units (figures in brackets).

Since the number of plant lists collected for each community is insufficient to allow of synthetic treatment of the plant associations, the floristic characterization of the units as reported here is only tentative and fragmentary. On the other hand, a considerable part of the plant communities mentioned below are well-known also from other deserts so that the delimitation and the names of these units will probably not be altered in the future. For the sake of convenience all the vegetational units are reported here as associations, although many of them may be considered as units of lower rank only.

(b) *The plant communities of the Hammada*

As already mentioned above the Hammada represents a rather heterogeneous soil type. Future studies will no doubt subdivide the Hammada into a series of habitats based upon microedaphical and topographical characteristics. Vegetation will no doubt confirm such a subdivision. For the time being we have distinguished within the area of the Hammada the following vegetational units:

(1) *Anabasisidetum articulati* (Eig 1938). This is the most common plant community of the desert not only in Sinai but also in Transjordan, Wadi Araba and Syrian Desert. The degree of coverage varies greatly with the topography and soil constitution. Very often this association occurs only in depressions and shallow wadis while the adjacent more elevated plains are absolutely free of vegetation. Except in wadis this association is very poor in number of associates. Here is a plant list of this association as noted in a gravel plain, near Anja el Hafir, 200 m<sup>2</sup>, coverage 1%:

<i>Anabasis articulata</i> <sup>1</sup>	+ — 2	<i>Plantago coronopus</i>	+ — 1
<i>Zygophyllum dumosum</i>	+ — 2	<i>Matthiola livida</i>	+ — 1
<i>Stipa tortilis</i>	+ — 1	<i>Bassia muricata</i>	+ — 1

<sup>1</sup> The figures and signs annexed to the plant names are estimate values of coverage + abundance and of sociability (see Braun-Blanquet, Pflanzensoziologie p. 30, 1928).

## EXPLANATION OF FIGURES AND SIGNS USED IN TRANSSECTS

Figures in vertical rows — altitude above S. L. in m.

Undulate line — approximate altitude of various points of transects.

Small figures above horizontal lines — distance in km. from Beersheba or Suez.

Letters below horizontal lines indicate the segments into which the transects have been subdivided.

Figures in bold type within the two lines of segments are the plant associations of the segment and correspond to the figures of the following list (open figures show that the association is dominant or common, while figures in brackets show that the association in question is rare or locally limited within the segment).

- |   |   |
|---|---|
| 1. <i>Anabasisidetum articulatae</i>                  | 18. <i>Verbascum Schimperianum</i> —                |
| 2. <i>Anabasis articulata</i> — <i>Zilla spinosa</i>  | <i>Stachys affinis</i>                              |
| 3. <i>Anabasis articulata</i> — <i>Noëa mucronata</i> | 19. <i>Hyoscyamum muticæ</i>                        |
| 4. <i>Anabasis articulata</i> — <i>Panicum</i>        | 20. <i>Achilleetum fragrantissimi</i>               |
| <i>turgidum</i>                                       | 21. <i>Nitrarietum retusæ</i>                       |
| 5. <i>Haloxylonetum salicornici</i>                   | 22. <i>Zygophylletum albi</i>                       |
| 6. <i>Haloxylon salicornicum</i> — <i>Zilla</i>       | 23. <i>Suaeda vermiculata</i> — <i>Zygophyllum</i>  |
| <i>spinosa</i>  | <i>coccineum</i>                                    |
| 7. <i>Aristidetum scopariæ</i>                        | 24. <i>Tamaricetum manniferae</i>                   |
| 8. <i>Artemisietum monospermae</i>                    | 25. <i>Juncetum arabici</i>                         |
| 9. <i>Retametum Roetami</i>                           | 26. <i>Capparidetum aegyptiacæ</i>                  |
| 10. <i>Panicetum turgidi</i>                          | 27. <i>Artemisietum judaicæ</i>                     |
| 11. <i>Aristidetum plumosæ</i>                        | 28. <i>Artemisia judaica</i> — <i>Zilla spinosa</i> |
| 12. <i>Fagonietum grandifloræ</i>                     | 29. <i>Zilletum spinosæ</i>                         |
| 13. <i>Zygophylletum dumosi</i>                       | 30. <i>Artemisietum Herbae albae</i>                |
| 14. <i>Reaumurietum hirtellæ</i>                      | 31. <i>Phlomis aurea</i> — <i>Pyrethrum</i>         |
| 15. <i>Haloxylonetum articulati</i>                   | <i>santolinoides</i>                                |
| 16. <i>Haloxylon articulatum</i> — <i>Zilla</i>       | 32. <i>Pyrethrum santolinoides</i> —                |
| <i>spinosa</i>  | <i>Artemisia Herba alba</i>                         |
| 17. <i>Ephedretum Alti</i>                            | 33. Stands of <i>Acacia tortilis</i>                |





In the majority of cases this association consists of *Anabasis* alone. The plant list given here must therefore not be taken as the most characteristic composition of this association.

Very abundant in central and eastern Sinai.

(2) *Anabasis articulata* — *Zilla spinosa* association (Eig 1.c). This may be considered only as a variety of the last, confined to wadis especially where the beds are covered with coarse sand. Here is one of the plant lists noted about 82 km. W. of Suez. General coverage 20%.

<i>Anabasis articulata</i>	1 — 2	<i>Zygophyllum dumosum</i>	+ — 2
<i>Zilla spinosa</i>	1 — 2	<i>Artemisia monosperma</i>	+ — 1
<i>Reumuria hirtella</i>	+ — 2		

It is limited only to transect II, segm. e, f.

(3) *Anabasis articulata* — *Noëa mucronata* association. Though very abundant in N.E. Sinai it is doubtful whether it may be regarded as a special unit. It is confined to Hammada plains covered by a thin layer of sand. As already mentioned, this sand cover has a great effect on absorption and retention of moisture and therefore this habitat is more favourable for plant growth than typical Hammada. This seems to be the only reason why *Noëa mucronata*, a typical Irano-Turanian plant, occurs here as a constant associate.

The composition of this plant community, as recorded from 20 km. W. of El Auja, is as follows:

Plain of sandy Hammada, area 400 m<sup>2</sup>, coverage 20%:

<i>Anabasis articulata</i>	1 — 2	<i>Thymelaea hirsuta</i>	+ — 1
<i>Noëa mucronata</i>	1 — 2	<i>Fagonia kahirina?</i>	+ — 1
<i>Salsola villosa</i>	+ — 2		

It occupies the plains of transect I, segm. c, d, e.

(4) *Anabasis articulata* — *Panicum turgidum* association. Where the layer of sands covering the Hammada is thicker. *Panicum* occurs as a codominant associate of the *Anabasidetum*. 80 km. West of el Auja the following composition of this community was noted:

Hammada plain covered with sand; area 100 m<sup>2</sup>; coverage 5%:

<i>Anabasis articulata</i>	+ — 2	<i>Lithospermum callosum</i>	+ — 1
<i>Panicum turgidum</i>	+ — 2	<i>Plantago cylindrica</i>	+ — 1
<i>Euphorbia cornuta</i>	+ — 1	<i>Eremobium aegyptiacum</i>	+ — 1
<i>Aristida plumosa</i>	+ — 1	<i>Launea tenuiloba</i>	+ — 1
<i>Polycarpea repens</i>	+ — 1	<i>Danthonia Forskahlei</i>	+ — 2
<i>Thymelaea hirsuta</i>	+ — 1	<i>Lotus villosus</i>	+ — 1

About 3 km. from the above mentioned place dead specimens of *Noëa* were found in this association. It is obvious that *P. turgidum* replaces *Noëa* here in deeper sands.

Met with in transect I, segm. f.

(5) *Haloxylonetum salicornici* (Eig 1.c). While *Anabasidetum articulati* and its allied associations are the dominant plant communities of the Hammadas in northern and north-eastern Sinai, *Haloxylonetum salicornici* is exclusively limited (as far as our area is concerned) to the Hammadas of western Sinai. The reasons for this geographical differentiation are not clear to



us. In contrast to *Anabasis*, *Haloxylon* is not an open desert plant. It is rather characteristic of great depressions (Wadi Araba, Wadi Ithm. etc.). Edaphically *Haloxylonetum salicornici* has hitherto been observed mainly on more or less compact sandy soil or sandy Hammadas (Southern Iraq, Negeb of Palestine), the sand of which is mostly derived from Nubian Sandstone. In western Sinai it is confined to Hammadas and more often to the shallow furrows and gullies breaking through the Hammada plains. The soil of these habitats is very often but not always sandy. Detailed observations could not be made in this direction.

As seen in transect III this association prevails along the whole coastal plain from Shatt to Wadi Feiran. It is, no doubt, composed of several subassociations which we were unable to define in this journey. Of the several plant lists at our disposal the following may be quoted:

Western Sinai. 88 km. S. of Shatt (on the Suez-Abu Zenima road); slight slope of a hill near wadi; sandy soil overlaying a gypseous crust; area 100 m<sup>2</sup>; coverage 30%:

<i>Haloxylon salicornicum</i>	2—2	<i>Gymnocarpon fruticosum</i>	+—1
<i>Gypsophila Rokejeka</i>	+—1	<i>Plantago cylindrica</i>	1—1
<i>Erodium glaucophyllum</i>	+—1	<i>Cotula cinerea</i>	1—1
<i>Helianthemum kahiricum</i>	+—1	<i>Ephedra Alti</i>	+—1
<i>Helianthemum ellipticum</i>	+—1	<i>Fagonia sp.</i>	+—1

On a more sandy Hammada of the same environs we observed the following associates:

<i>Haloxylon salicornicum</i>	2—3	<i>Atractylis flava</i>	+—1
<i>Plantago cylindrica</i>	1—1	<i>Cotula cinerea</i>	+—1
<i>Savignya parviflora</i>	+—1	<i>Launea sp.</i>	+—1
<i>Aristida plumosa</i>	+—1	<i>Eremobium lineare</i>	+—1

In a broad bed of Wadi Sidri (about 25 km. S. of Abu Zenima) covered with gravel and pebble the coverage was 20% and the composition as follows:

<i>Haloxylon salicornicum</i>	3—3	<i>Sclerocephalus arabicus</i>	+—1
<i>Artemisia judaica</i>	+—1	<i>Asphodelus tenuifolius</i>	+—1
<i>Zilla spinosa</i>	+—1	<i>Asteriscus graveolens</i>	+—1
<i>Cotula cinerea</i>	+—1	<i>Neurada procumbens</i>	+—1
<i>Aristida plumosa</i>	+—1	<i>Atractylis flava</i>	+—1
<i>Plantago cylindrica</i>	+—1	<i>Danthonia Forskahlei</i>	+—1
<i>Fagonia Bruggieri</i>	+—1	<i>Polycarpea repens</i>	+—1
<i>Diplotaxis Harra</i>	+—1		

As is evident from the above the composition very often varies according to soil constitution but *Haloxylon* occurs everywhere as the dominant plant. The entire area between Suez and Wadi Feiran may in general be considered as dominated by *Haloxylonetum salicornici* and its variants. The other associations occurring in this area (see transect III) are limited in their distribution and confined to particular habitats such as deep wadis or salines, etc. Further south, in Wadi Feiran, *Haloxylonetum* continues to be also common but here Hammada plains disappear and *Haloxylon* is confined only to the banks or higher terraces of the wadis covered with gravel. Here, however, *Zilla spinosa* becomes a codominant associate so as to form a special vegetational unit, viz:

(6) *Haloxylon salicornicum* — *Zilla spinosa* association. It is confined to banks of wadis only. About 17 km. east of the entrance to Wadi Feiran we noted the following plants:

<i>Haloxylon salicornicum</i>	2 — 3	<i>Cleome arabica</i>	+ — 1
<i>Zilla spinosa</i>	+ — 3	<i>Verbascum sinaiticum</i>	+ — 1
<i>Farsettia aegyptiaca</i>	+ — 1	<i>Hyoscyamus muticus</i>	+ — 1

On entering Wadi Sheikh (800 m. a. S.L.), *Haloxylonetum* is forced to share its ground with *Artemisietum judaici*, the former being confined to gravelly banks of wadis, while *Artemisietum* occupies the sandy bed of the wadi. *Haloxylonetum* is pushed further away until at an altitude of about 1000 m. above S.L., *Haloxylon* entirely disappears.

(c) *Vegetation of sand dunes and sand plains*

(7) *Aristidetum scopariae*. This association is widely distributed in northern Sinai. It occupies more or less calm slopes of shifting sand dune ridges (transsect I, segm. c, g, i, j), and the top of relatively stable dunes (transsect I, segm. c, e, f). As far as we could observe, this association is rather monospecific, *Aristida* being the only plant occurring on vast dune areas. Apart from Sinai we have observed this association also on the dunes of southern Palestine.

(8) *Artemisietum monospermae*. This is a rather common association both in stable dunes of northwestern Sinai and in sandy beds of wadis (transsects I, g; II, f), but the total area it occupies is rather small. Often this association is mixed with associates of the *Retametum* occurring in its vicinity. In some places, however, it forms pure stands of *Artemisia*.

(9) *Retametum Roetami sinaiticum*. Although considered under the class of psammophytic vegetation, the *Retametum* is far from being limited to sandy habitats. From several observations in Palestine and the Sinai Peninsula it is obvious that this association has a very wide range of ecological requirements. In Sinai it was observed by us on stable dunes, in thresholds between dunes, gravelly and sandy beds of wadis, etc.

In the following we wish to quote two examples of the composition of this association in Sinai, one of a psammophytic habitat, the other of a gravelly wadi bed.

(a) 35 km. E. of Suez, sandy bed of wadi, area 500 m<sup>2</sup> coverage 50%:

<i>Retama Roetam</i>	2 — 4	<i>Schismus calicinus</i>	+ — 1
<i>Artemisia monosperma</i>	2 — 2	<i>Ifoga spicata</i>	+ — 1
<i>Achillea fragrantissima</i>	1 — 1	<i>Brodium bryoniaefolium</i>	+ — 1
<i>Zilla spinosa</i>	2 — 3	<i>Picris</i> sp.	+ — 1
<i>Haloxylon salicornicum</i>	2 — 3	<i>Fagonia</i> sp.	+ — 1
<i>Lycium europaeum</i>	+ — 3	<i>Centaurea sinaica?</i>	+ — 1

(b) about 170 km. E. of Suez, near Jebel Helal, bed of wadi, covered with gravel and boulders:

<i>Retama Roetam</i>	— 3	<i>Matthiola arabica</i>	+ — 1
<i>Stachys affinis</i>	2 — 2	<i>Farsettia aegyptiaca</i>	+ — 1
<i>Haplophyllum tuberculatum</i>	1 — 1	<i>Reseda pruinos</i>	+ — 1
<i>Thymelaea hirsuta</i>	+ — 1	<i>Reseda decursiva</i>	+ — 1
<i>Asphodelus tenuifolius</i>	+ — 1	<i>Avena Wiestii</i>	+ — 1
<i>Halogeton alopecuroides</i>	+ — 1	<i>Aristida ciliata</i>	+ — 1
<i>Pycnocycla tomentosa</i>	+ — 1	<i>Aristida obtusa</i>	+ — 1
<i>Helianthemum seseliflorum</i>	+ — 1	and many others	



The composition of this *Retametum* is a very occasional; being situated near the hills a good number of the hill flora enters into this association.

(10) *Panicetum turgidi*. It occurs in the western part of the Suez-Auja road in places where the Hammada is covered with a deep layer of compact sand. The habitat is very similar to that occupied by the *Anabasis articulata* — *Panicum turgidum* association of transect I. Here, however, *Panicum turgidum* is limited within the dominion of *Haloxylonetum salicornici*. The composition of this association was noted from about 5 km. E. of Suez:

Bed of a sandy wadi, in the midst of a sterile Hammada, area 400 m<sup>2</sup>; coverage 25%:

<i>Panicum turgidum</i>	1—3	<i>Plantago ovata</i>	+—1
<i>Artemisia monosperma</i>	+—2	<i>Aristida plumosa</i>	+—1
<i>Devera tortuosa</i>	+—1	<i>Savignya parviflora</i>	+—1
<i>Echinops spinosa</i>	+—1	<i>Zygophyllum album</i>	+—1
<i>Monsonia nivea</i>	+—1	<i>Polycarpea repens</i>	+—1
<i>Cotula cinerea</i>	+—1	<i>Atractylis flava</i>	+—1
<i>Matthiola livida</i>	+—1		

(11) *Aristidetum plumosae*. It is limited only to the western part of the Suez-Auja route where it is confined to depressions filled with coarse sand within the sterile Hammada plain. The difference between this and the habitat of *Panicetum* is rather slight. The following list was noted at 25 km. E. of Suez on a slight sandy slope sparsely strewn with gravel, area 50 m<sup>2</sup>, coverage 10%.

<i>Aristida plumosa</i>	2—1	<i>Plantago cylindrica</i>	+—1
<i>Eremobium lineare</i>	1—1	<i>Atractylis flava</i>	+—1
<i>Silene villosa</i>	+—1	<i>Ifloga spicata</i>	+—1
<i>Silene affinis</i>	+—1	<i>Anthemis</i> sp.	+—1
<i>Danthonia Forskahlei</i>	1—1	<i>Cutandia dichotoma</i>	+—1
<i>Monsonia nivea</i>	+—1	<i>Scabiosa eremophila</i>	+—1
<i>Fagonia Bruguieri</i>	+—1	<i>Asphodelus viscidulus</i>	+—1
<i>Cornulaca monacantha</i>	+—1	<i>Neurada procumbens</i>	+—1

Of this association we possess several records; it is comparatively rich in species and is composed almost entirely of typical psammophytes.

(12) *Fagonietum (grandiflorae?)*. It is very near to the last in composition and in character of habitat and it differs by that *Fagonia* occurs as a leading plant. It is confined to the eastern part of the transect II, which lies 200—300 m. higher than the habitats of *Aristidetum plumosae*. A single record noted from about 20 km. E. of Bir Hassana in a sandy depression within the Hammada shows the following composition (coverage 40%).

<i>Fagonia (grandiflora?)</i>	2—2	<i>Savignya parviflora</i>	+—1
<i>Aristida plumosa</i>	2—1	<i>Echiochilon fruticosum</i>	+—1
<i>Convolvulus lanatus</i>	1—2	<i>Atractylis flava</i>	+—1
<i>Eremobium lineare</i>	2—1	<i>Ephedra Alte</i>	+—1

#### (d) *Vegetation of rocky hills (Northern Sinai)*

(13) *Zygophylletum dumosi* (Eigl. c.). This is one of the most characteristic plant associations of the lower hills of Northern Sinai and the

adjacent Negeb of Palestine. Despite the lack of a continuous soil cover, the coverage is rather considerable and the number of species strikingly high, especially of perennials. We have had occasion to examine hillsides with southern and northern exposure and found in both more or less similar composition of the plant association. Of the records collected we wish to quote here two plant lists, one of the typical form confined to stony hillsides and the other from a wadi bed adjacent to hills.

(a) Northern slope of a hill of the Jiddi mountains (33 km. E. of Suez). Grey calcareous rock splitting into medium sized blocks and gravel; slope 35°, area 500 m<sup>2</sup>; coverage 40—50%.

<i>Zygophyllum dumosum</i>	1—2	<i>Silene linearis</i>	+—1
<i>Reaumuria hirtella</i>	1—2	<i>Stipa tortilis</i>	1—1
<i>Gymnocarpus fruticosus</i>	1—2	<i>Rumex roseus</i>	+—1
<i>Artemisia Herba alba</i>	1—2	<i>Matthiola livida</i>	+—1
<i>Halogeton alopecuroides</i>	+—2	<i>Atractylis flava</i>	+—1
<i>Farsetia ovalis</i>	+—2	<i>Asteriscus pygmaeus</i>	+—1
<i>Chenolea arabica</i>	+—2	<i>Pieranthus echinatus</i>	+—1
<i>Helianthemum kahiricum</i>	+—1	<i>Plantago ovata</i>	+—1
<i>Asparagus stipularis</i>	+—2	<i>Senecio coronopifolia</i>	+—1
<i>Fagonia</i> sp.	+—1	etc.	

Although *Zygophyllum* is here less abundant than *Gymnocarpus* or other perennials, the floristical character and the constitution of the habitat suggest a *Zygophylletum* rather more than any other plant community.

(b) Wadi about 30 km. E. of Bir el Hassana, somewhat elevated terrace of the bed; soil covered with stones.

<i>Zygophyllum dumosum</i>	2—2	<i>Rarsettia ovalis</i>	+—2
<i>Ephedra Alte</i>	+—2	<i>Zilla spinosa</i>	+—2
<i>Anabasis articulata</i>	1—2	<i>Asteriscus graveolens</i>	+—1
<i>Artemisia Herba alba</i>	+—2	<i>Pulicaria undulata</i>	+—1
<i>Statice pruinosa</i>	+—1	<i>Haloxyton articulatum</i>	+—2

(14) *Reaumurietum hirtellae*. This is very near in composition and habitat to the *Zygophylletum dumosi* and future studies may reveal that it is only a variety of this. Unfortunately we did not take notes on this association from the hills of Northern Sinai where it seems to be characteristic of the lower parts of those hills on which *Zygophylletum* occupies the higher zones. In our transects we therefore included this community within the area of *Zygophylletum*. The following plants were noted in Wadi Taiba about 10 km. N. of Abu Zenima. A broad bed covered with great boulders of calcareous rocks; coverage 10%:

<i>Reaumuria hirtella</i>	1—2	<i>Caylussea canescens</i>	+—1
<i>Atriplex parvifolia</i>	+—1	<i>Atractylis flava</i>	+—1
<i>Haloxyton salicornicum</i>	+—2	<i>Pulicaria undulata</i>	+—1
<i>Morettia canescens</i>	+—1	<i>Diploaxis Harra</i>	+—1
<i>Fagonia</i> sp.	+—1	<i>Zygophyllum simplex</i>	+—1
<i>Moricandia sinaica</i>	+—2	<i>Nasturtiopsis arabica</i>	+—1

Here again the plant list is not typical and, no doubt, plants of other plant communities occasionally found in the wadi are included in this list. In general, it may be remarked that vegetation of the bigger wadis suffers heavily from torrential streams occurring in winter and invasion of plants



starts anew year by year. We wish also to mention that a third plant association, viz.: *Gymnocarpetum fruticosi*, well-known from the deserts of Palestine and very near *Zygophylletum*, was observed by us twice in Sinai in a rather fragmentary state (about 45 km. N. of Abu Zenima and on the slopes facing Wadi Feiran).

#### (e) Vegetation of loess soils

As mentioned above a kind of loess soils is deposited in Northern Sinai mainly in the valleys between the calcareous hills. We observed two plant associations dominating on and characteristic of these habitats.

(15) *Haloxylonetum articulati* (Eig. l.c.). Its main centre is the southern Negeb of Palestine. In Sinai we observed it only along the Auja-Suez route. Its typical form is here restricted to the vicinity of the *Zygophylletum dumosi* area. The following composition was observed in the environs of Jebel Jiddi about 40 km. E. of Suez. Soil compact, bright, loessy; area 500 m<sup>2</sup>; coverage 75%.

<i>Haloxylon articulatum</i>	1(2)—2	<i>Avena Wiestii</i>	+ — 1
<i>Centaurea sinaica?</i>	1 — 1	<i>Matthiola livida</i>	+ — 1
<i>Stipa tortilis</i>	3 — 1	<i>Asphodelus pendulinus</i>	+ — 1
<i>Ifloga spicata</i>	1 — 1	<i>Paronychia lenticulata</i>	+ — 1
<i>Asphodelus tenuifolius</i>	+ — 1	<i>Hippocrepis bicontorta</i>	+ — 1
<i>Erodium hirtum</i>	+ — 1	<i>Pteranthus echinatus</i>	+ — 1
<i>Plantago Coronopus</i>	1 — 1	<i>Trigonella stellata</i>	+ — 1
<i>Stachys affinis</i>	+ — 1	etc.	

(16) *Haloxylon articulatum* — *Zilla spinosa* association. This was observed in broad wadis of an open Hammada plain. Of the few records available one may be quoted here:

76 km. E. of Suez, a broad shallow wadi; coverage 25%:

<i>Haloxylon articulatum</i>	1 — 2	<i>Stipa parviflora</i>	+ — 1
<i>Zilla spinosa</i>	1 — 2	<i>Astragalus spinosus</i>	+ — 2
<i>Gymnocarpus fruticosus</i>	1 — 2	<i>Deverra tortuosa</i>	+ — 1

#### (f) Vegetation of greater wadis

There is a group of plant associations which are never met with in open plains and even not in small shallow wadis. Although their particular ecological requirements are unknown to us, they are worthy of mention as they constitute a rather striking feature in the vegetation of Sinai. Apart from *Retametum* already mentioned above the following may be briefly quoted here.

(17) *Ephedretum Alte*. *Ephedra Alte* is one of the most common shrubs in the area investigated. In certain localities it is one of the dominating plants limited to wadis, elevated banks and slopes facing greater wadis. The composition of the *Ephedretum* varies greatly. Here is a plant list of this association noted about 30 km. N. of Abu Zenima.

Slope of a wadi bank; N. exposure; area 400 m<sup>2</sup>; coverage 15%:

<i>Ephedra Alte</i>	1 — 3	<i>Reichardia tingitana</i>	+ — 1
<i>Gymnocarpus fruticosus</i>	1 — 3	<i>Stipa tortilis</i>	+ — 1
<i>Helianthemum kahiricum</i>	+ — 2	<i>Plantago cylindrica</i>	+ — 1
<i>Diploxix Harra</i>	+ — 2	<i>Savignya parviflora</i>	+ — 1
<i>Halogeton alopecuroides</i>	+ — 2	<i>Matthiola livida</i>	+ — 1
<i>Centaurea calcitrapella</i>	+ — 1		

(18) *Verbascum Schimperianum* — *Stachys affinis* association. This association we have observed only in Northern Sinai on the border of a wadi near the southern slope of Jiddi Hills. The plant list is only fragmentary.

<i>Verbascum Schimperianum</i>	} dominating	<i>Amberboa crupinoides</i>
<i>Stachys affinis</i>		<i>Stipa tortilis</i>
<i>Heliotropium rotundifolium</i>		<i>Avena Wiestii</i>
<i>Farsettia ovalis</i>		<i>Phalaris minor</i>
<i>Astragalus sanctus</i>		<i>Silene setacea</i>
<i>Astragalus spinosus</i>		<i>Paronychia sinaica</i> etc.

(19) *Hyoscyamum mutici*. Met with in wadis on silty or sandy stoneless beds. The following composition was found in Bir el Hassana:

Flat wadi bed, white compact stoneless soil; area 100 m<sup>2</sup>; coverage 40%:

<i>Hyoscyamus muticus</i>	2 — 2	<i>Reaumuria hirtella</i>	+ — 2
<i>Zygophyllum coccineum</i>	1 — 2	<i>Diploaxis acris</i>	+ — 1

(20) *Achilleetum fragrantissimae*. It is confined to rather deep gravelly wadis and to elevated terraces of wadi beds. Rather common in N.E. Sinai and S. Palestine; always occupies very limited areas. No notes were taken on the composition of this association in Sinai.

#### (g) Vegetation of salines

(21) *Nitrarietum retusae*. At the outlet region of the greater wadis and in the area of springs and inundated depression *Nitrarietum* is one of the most common and characteristic associations. Here it is limited to sandy or calcareous or somewhat muddy isolated mounds. The interspaces between these mounds are often entirely bare. The landscape dominated by *Nitrarietum* has an appearance of a "bad land". We observed this association at Kussaima, Bir Hassana, Ayun Musa (very abundant here). Wadi Nakhl, Wadi Shallal, Wadi Gharandel, etc. The mode of formation of the above mentioned mounds is obscure to us. In Wadi Gharandel the *Nitraria* bushes form pure stands. In other places they are accompanied by *Tamarix articulata* and *Tamarix tetragyna* bushes. Other plants occurring rarely between the bushes of *Nitraria* or *Tamarix* are *Bassia eriophora*, *Zygophyllum simplex*, *Atriplex dimorphostegium*, *Cotula cinerea*, *Schismus arabicus* (?), *Zygophyllum album*, *Plantago cylindrica*, *Plantago ciliata*.

(22) *Zygophylletum albi*. This association is rather common on flat and saline lands in the coastal plain of the Red Sea. In the environs of Abu Zenima the following components were noted:

Plain of coarse and moist sand highly saline; coverage 60%:

<i>Zygophyllum album</i>	3 — 1	<i>Plantago cylindrica</i>	+ — 1
<i>Zygophyllum coccineum</i>	+ — 1		

(23) *Suaeda vermiculata* — *Zygophyllum coccineum* association. Occupies wide stretches S. of Abu Zenima in the depressions of the coastal plain. The soil is here more moist and seemingly more saline than in the above *Zygophylletum*. Three species were noted here: *Suaeda*



*vermiculata*, *Zygophyllum album*, *Haloxylon salicornicum*? Within the area of this association we observed in smaller furrows pure dense stands of *Mesembryanthemum Forskahlei*.

(24) *Tamaricetum manniferae*. Very abundant along the banks of Wadi Shallal, Wadi Gharandel, Wadi Taiba and other wadis, often forming dense and pure stands of medium sized trees. We could not always decide whether the *Tamarix* in question belongs to *T. nilotica* or to *T. mannifera*, generally recorded from these localities. While in the Wadi Feiran *T. mannifera* is stated to be dominant, in the wadis crossing the coastal plain, between Wadi Feiran and Suez *T. nilotica* may also occur.

(25) *Juncetum arabici*. Observed only once in Ayun Musa near water, as a fragmentary stand of *Juncus maritimus* var. *arabicus*. Accompanied by *Polypogon monspeliense*, *Zygophyllum album* and *Alhagi Maurorum*.

#### (h) Vegetation of vertical calcareous rocks

(26) *Capparidietum aegyptiacae* in Wadi Taiba. Isolated bushes of *Capparis* arising from the rocks in a somewhat shady exposure.

#### (i) Vegetation of the mountain region (Wadi Sheikh and Mt. Sinai)

From 1000 m. above S.L. vegetation changes rapidly with altitude. *Haloxylonetum salicornici* and its varieties which dominate the entire western part of Sinai disappear at once and are replaced by other plant communities. From Wadi Sheikh upwards to the top of Mt. Sinai the Irano-Turanian element well represented by *Artemisia Herba alba* gains more and more territory. The reason for these changes is no doubt the increasing altitude resulting in climatic changes. One of these is the increase of atmospheric precipitations and the occurrence of snowfall (from 1000 m. upwards).

In contrast to the vegetation of the northern and northeastern Sinai the delimitation of the plant communities is here rather difficult and requires a thorough examination. As such examinations could not be made by us during the hasty ascent to Mt. Sinai, the plant communities mentioned here must be regarded only very tentative and preliminary.

(27) *Artemisietum judaicae*. This association appears first in Wadi Sheikh at the entrance from Wadi Feiran. It is confined to wadi beds made up of compact sand derived of granite rock. Here at an altitude of about 800 m. the following notes were made:

Wadi bed, a packed sandy soil, covered with coarse sand, area 400 m<sup>2</sup>; coverage 40%:

<i>Artemisia judaica</i>	2 — 2'	<i>Flora spicata</i>	+ — 1
<i>Artemisia Herba alba</i>	+ — 2	<i>Gastrocotyle hispida</i>	+ — 1
<i>Pulicaria undulata</i>	+ — 1	<i>Schismus calycinus</i>	+ — 1
<i>Caylussea canescens</i>	+ — 1	<i>Paracaryum micranthum</i>	+ — 1
<i>Asphodelus tenuifolius</i>	+ — 1	<i>Plantago ciliata</i>	+ — 1
<i>Leyssera capillifolia</i>	+ — 1	<i>Morettia canescens</i>	+ — 1
<i>Stipa tortilis</i>	+ — 1		

This plant association dominates about 10 km. of our route to the

Mt. Sinai; later on *Zilla spinosa* appears as codominant with *Artemisia judaica*.

(28) *Artemisia judaica*—*Zilla spinosa* association. At an altitude of about 1000 m. this vegetation unit covers the sandy and somewhat gravelly beds of Wadi Sheikh. At km. 226 of our route (see transect III) we noted:

Bed of W. Sheikh, sandy soil mixed and sparsely covered with gravel; area 400 m.<sup>2</sup>; coverage 15%:

<i>Artemisia judaica</i>	1—2	<i>Matthiola arabica</i>	+—1
<i>Zilla spinosa</i>	1—2	<i>Stipa tortilis</i>	+—1
<i>Fagonia grandiflora</i>	+—2	<i>Caylusea canescens</i>	+—1
<i>Forsetia ovalis</i>	+—2	<i>Hyoscyamus pusillus</i>	+—1

No doubt that this association is only transitory between the *Artemisietum judaicae* and the *Zilletum spinosi* which begins to dominate from about 20 km. N. of the Convent of St. Katherina up to the foot of Mt. Sinai.

(29) *Zilletum spinosae*. It dominates from about 20 km. N. of the Convent of St. Katherina up to the foot of Mt. Sinai.

Here at about 20 km. N. of the Convent the following species were noted:

Bed of sandy, gravelly wadi; area 400 m.<sup>2</sup>; coverage 20%:

<i>Zilla spinosa</i>	1—2	<i>Matthiola livida</i>	+—1
<i>Artemisia Herba alba</i>	+—2	<i>Alkanna tinctoria</i>	+—1
<i>Artemisia judaica</i>	+—2	<i>Glaucium arabicum</i>	+—1
<i>Leyssera capillifolia</i>	+—2	<i>Centaurea sp.</i>	+—1

It must be remarked that this and the two aforementioned associations are confined only to the wadis. On the adjacent slopes no vegetation is to be seen except in fissures, furrows and cavities. One of those furrows of a granite mountain slope facing Wadi Sheikh was examined and the following plants were noted:

<i>Stachys affinis</i>	<i>Forsetia ovalis</i>	<i>Oryzopsis miliacea</i>
<i>Artemisia Herba alba</i>	<i>Glaucium arabicum</i>	<i>Ballota Kaiserii</i>
<i>Lycium europaeum</i> ?	<i>Lawandula coronopifolia</i>	<i>Blepharis edulis</i>
<i>Reaumuria hirtella</i>	<i>Morettia canescens</i>	<i>Trichodesma africana</i>
<i>Gymnocarpus fruticosus</i>	<i>Andrachne telephioides</i>	<i>Reseda pruinoso</i>
<i>Pennisetum ciliare</i>	<i>Solanum sinaïticum</i>	<i>Teucrium pilosum</i>
<i>Tripteris Vaillantii</i>	<i>Galium sinaïcum</i>	<i>Paracaryum micranthum</i>
<i>Psoralea flaccida</i>		

Floristically we find here a rich Irano-Turanian flora mixed with Saharo-Sindian and Sudano-Deccanian plants. Vegetationally, however, no definite unit can be selected out from this plant accumulation.

On the other hand, *Zilletum spinosi* as a clearly definite unit prevails over the wadis and their ascents up to an altitude of 1630 m.

(30) *Artemisietum Herbae albae*. (Fig 1. c.). In Mt. Sinai, at 1630 m.—1700 m. above S.L., *Zilletum* is replaced by a kind of *Artemisietum Herbae albae* very rich in Irano-Turanian hemicryptophytes and chamaephytes. A list of typical plants collected in this zone may be recorded here:



<i>Artemisia Herba alba</i> dominating	<i>Diploaxis Harra</i>	<i>Deverra tortuosa</i>
<i>Pyrethrum santolinoides</i>	<i>Atraphaxis sinaica?</i>	<i>Varthemia montana</i>
<i>Teucrium pilosum</i>	<i>Echinops spinosa?</i>	<i>Lactuca orientalis</i>

(31) *Phlomis aurea*—*Pyrethrum santolinoides* association. This association, as far as it may be regarded as a defined phytosociological unit, is very peculiar in composition. It prevails mainly approximately between 1700—2000 m. The following plants were noted within the area of this association:

<i>Phlomis aurea</i> (dom.)	<i>Teucrium pilosum</i>	<i>Arenaria graveolens</i>
<i>Pyrethrum santolinoides</i> (dom.)	<i>Ballota Kaiseri</i>	<i>Alkanna tinctoria</i>
<i>Ficus pseudosycamoros</i>	<i>Origanum sinaicum</i>	<i>Scandix australis</i>
<i>Crataegus sinaicus</i>	<i>Linaria Acerbiana</i>	<i>Galium sinaicum</i>
<i>Atraphaxis sinaica</i>	<i>Artemisia Herba alba</i>	<i>Clypeola microcarpa</i>
<i>Ajuga tridactylitis</i>	<i>Phagnalon sinaicum</i>	<i>Lappula sinaica</i>
<i>Thymus decussatus</i>	<i>Echinops spinosus</i>	<i>Stipa parviflora</i>
<i>Stachys affinis</i>	<i>Varthemia montana</i>	<i>Parietaria alsinefolia</i>
<i>Nepeta septemcrenata</i>	<i>Dianthus sinaicus</i>	<i>Plantago arabica</i>

(32) *Pyrethrum santolinoides*—*Artemisia Herba alba* association. This association is characteristic for the highest zone of Mt. Sinai from about 2000—2250 m. *Phlomis aurea* which was the most dominating shrub of the former zone entirely disappears here giving place to *Artemisia Herba alba* which is much more abundant than in the former zone.

The plants observed in this zone are:

<i>Pyrethrum santolinoides</i> (dom.)	<i>Onopordon</i> sp.
<i>Artemisia Herba alba</i> (dom.)	<i>Poa sinaica</i> and many others
<i>Anarrhinum orientale</i>	of the former zone.
<i>Nepeta septemcrenata</i> (very abundant)	

Apart from these plant communities we observed some other local plant communities in special habitats, viz.: between 1900—2000 m. near a spring: *Scirpus Holoschoenus*, *Adiantum Capillus Veneris* and *Veronica Anagallis*. In another moist terrace we collected *Sphaenopus divaricatus*, *Polypogon maritimus*, *Vulpia myurus*. On the top of Mt. Sinai near ruins *Zilla spinosa* (single specimen), *Ephedra Alte*, *Peganum Harmala*, *Sisymbrium bilobum* were observed.

#### SUMMARY

(1) An enumeration of the main vegetation units encountered along three transections in northern and western Sinai was given here.

(2) For a series of species and plant communities a description of the habitat has been recorded here for the first time.

(3) The phytosociological value of a series of plants and plant communities has been revealed.

(4) It is shown that the Hammadas of the N.W. district are generally dominated by *Anabasisidetum articulatae* and allied plant communities, while in those of the western district *Haloxylonetum salicornici* is dominating, ranging from Sea Level to about 1000 m. above S.L.

(5) The sand dunes of the N. district are dominated by *Aristidetum scopariae* accompanied by *Artemisietum monospermae* and *Retametum Roctami sinaiticum*.

(6) The transection from the lowland vegetation to that of the mountains was followed and the changes of vegetation with increasing altitude pointed out.

(7) In general it was shown how richly differentiated is the vegetation of the desert despite its relatively poor flora.

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# REVISION OF THE ORIENTAL SCROPHULARIA SPECIES OF THE HERBARIUM OF THE HEBREW UNIVERSITY

By A. Eig<sup>1</sup>

(With Plate II)

The present revision of the *Scrophularia* species of Palestine, Syria, Iraq and Southern Turkey is based on the material of the Herbarium of the Hebrew University, collected chiefly by the author and his collaborators<sup>2</sup>.

Stiefel-hagen (1910), the author of the last revision of this genus, reported the following species for Syria: *S. peregrina* L., *S. nusairiensis* Post, *S. macrophylla* Boiss., *S. alata* Gilib., *S. scariosa* Boiss., *S. Michoniana* Cass. et Kral., *S. tagetifolia* Boiss. et Haussk., *S. lucida* L., *S. xylorrhiza* Boiss. et Haussk., *S. xanthoglossa* Boiss., *S. hypericifolia* Wydler, *S. libanotica* Boiss., in all 12 species. In the second edition of Post's Flora (1933), Dinsmore gave 5 other species for Syria: *S. Scopolii* Hoppe, *S. antiochia* Post (according to Stiefel-hagen, a synonym of *S. nusairiensis* Post), *S. sphaerocarpa* Boiss. et Reut. (according to Stiefel-hagen, a synonym of *S. lucida*), *S. Peyroni* Post (according to Stiefel-hagen a synonym of *S. xanthoglossa*), *S. variegata* M.B. Finally, Handel-Mazzetti (1912) cited for Syria (Aleppo) *S. nodosa* L. In all 18 species have been thus recorded for Syria.

For Palestine Stiefel-hagen reported the following 6 species: *S. peregrina* L., *S. macrophylla* Boiss., *S. Michoniana* Cass. et Kral., *S. xylorrhiza* Boiss. et Haussk., *S. xanthoglossa* Boiss., *S. hypericifolia* Wydler. Dinsmore (1933) listed 6 more species for this country: *S. alata* Gilib., *S. lucida* L., *S. sphaerocarpa* Boiss. et Reut., *S. heterophylla* Willd., *S. variegata* M.B., *S. canina* L. Thus 12 species in all are given for Palestine. For Palestine and Syria together

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<sup>1</sup> Posthumous.

<sup>2</sup> Abbreviations: District: A=Amman; CA=Carmel; CN=Coastal Plain of Negeb; E=Edom; EP=Esdraelon Plain; G=Gilead; HP=Huleh Plain; JD=Judean Desert; JM=Judean Mountains; LG=Lower Galilee; LJ=Lower Jordan Valley; N=Negeb; SH=Shephela; UG=Upper Galilee; UJ=Upper Jordan Valley. Collectors: E=A. Eig; F=N. Feinbrun; Z=M. Zohary.

Stiefel-hagen recorded 13 different species. Including the data of Post's Flora and those of Handel-Mazzetti there is a total of 21 different species reported for Palestine and Syria.

For Iraq Stiefel-hagen cited 6 species: *S. alata* Gilib., *S. mesopotamica* Boiss., *S. rimarum* Bornm., *S. xylorrhiza* Boiss. et Haussk., *S. xanthoglossa* Boiss., and *S. marginata* Boiss.

The study of the *Scrophularia* material of our Herbarium brought about considerable changes in the list of this genus for the above countries. I am following in my list the order of the *Scrophularia* species as established in the Flora Orientalis of Boissier not only because it is convenient for the revision of the oriental collection, but also because I do not see any great advantage in Stiefel-hagen's system over that of Boissier.

#### ENUMERATION

1. *Scrophularia Kotschyana* Bth. — DC. Prod. 10:303 (1846).

S. Turkey: Taurus Mts.: Bulgardagh, El-Mala, shaded rocks in a wadi, 1760 m. (22.viii.1931 EZ).

2. *Scrophularia peregrina* L.—Sp. pl.:866 (1753).

Lebanon: Beirut, fields (16.iv.1931 Dinsmore).

Stiefel-hagen reports this plant for Palestine. This is more than doubtful and this species should be excluded from the list of Palestinian plants.

3. *Scrophularia Scopolii* Hoppe. — Pers. Syn. 2:160 (1807).

Syria: N. Lebanon: Env. of Merj-el-Tawil, near Merj Hine, W. of Harmal 1800 m. (14.vii.1934 EFZ).

Kotschy found it in Amanus Mt., Post in Nussairy Mts.

Our locality is the southermost for the distribution of this species.

4. *Scrophularia Guestii* Eig sp. nov. Plate II.

Biennis, 40—50 cm. alta, tota brevissime viscidule-crispo-pubescens, caulibus foliosis, inferne ramosis, subacute quadrangulis, in thyrsum brevem abeuntibus. Folia membranacea, petiolata, ovato-oblonga, acuta, dentata vel serrata, anastomosantia, inferiora basi subcordata, caetera basi cuneata. Bractee lanceolato-lineares, summae lineares. Cymae simplices, 1—3 florum. Pedicelli calyce 3—4 plo longiores. Calycis lacinae puberulae, ovatae, angusto-marginatae, 2 mm. longae. Corolla glabra, fusco-virens, 7 mm. longa et 4 mm. lata, lobo superiore longiore; stamina inclusa; appendix reniformis, parva, apice rotundato. Capsula ovata, sensim apiculata, 6 mm. longa.



Iraqian Kurdistan: Arl-Gird-Dagh, by a stream, 8500 feet (24.vii.1932 Guest, under *S. alata* Gilib. var *cordata* Boiss.)

The nearest species is *S. crenophila* Boiss. from Persian Kurdistan. The new species is distinguished from the latter by the acute and acutely dentate leaves, larger and less numerous flowers, in that the apex of the appendix is not "subretusa" etc. By its inflorescence and capsule it is easily distinguished from *S. kurdica* sp. nov.

## 5. *Scrophularia kurdica* Eig sp. nov. Plate II.

Biennis, 40—50 cm. alta, tota breviter viscidulo-pubescens et parte glandulosa, caulibus foliosis, simplicibus, rarius ramosis, fere teretibus vel obtusangulis. Folia brevissime petiolata usque subsessilia, ampla, ovata usque ovato-oblonga et (praesertim superiora) oblonga, acuta vel obtusa, anastomosantia, crenata usque serrata, basi saepe subcordata. Cymae ex omnibus fere axillis divaricatum 5—multiflorae, glandulosae, pedunculo 20—25 mm. longo suffultae. Bractae lineari-subulatae, pedicello multo breviores. Pedicelli calyce 3—5 plo longiores. Calycis lacinae glabrae, ovatae, lato-marginatae, 1.5 mm. longae. Corolla glabra, fusco-virens, 7 mm. longa et 4 mm. lata, lobo superiore vix longiore; stamina inclusa; appendix reniformis, parva. Capsula globosa, 4 mm. longa breviter apiculata.

Iraqian Kurdistan: Sulaimani District: Pir-i-Mukurun Dag, rocks, near the snow (19.ix.1933 E, Duvdevani); there Mergapan, rocks, 1200—1300 m. (19.ix.1933 Z, Amdursky).

It is distinguished from *S. divaricata* Ledeb. by the short-petiolate leaves, which are not "acute lobatis", by the globular capsule, etc. From *S. crenophila* Boiss. it is distinguished by the axillary cymes, etc.

## 6. *Scrophularia antiochia* Post — Pl. Post. 5:13 (1893).

Northern Syria: Env. of Dafne, SW of Antiochia, rocks (4.vii.1932 EZ).

Stiefelhaagen (l.c.) reduced *S. antiochia* to a simple synonym of *S. nusairiensis* Post. I cannot share this view; these are two different species. *S. antiochia* has been known till now only from the original specimens of Post.

## 7. *Scrophularia clematidifolia* Eig sp. nov. Plate II.

Perennis, elata, caulibus ramosissimis, foliatis, acute quadrangulis glabris, in thyrsus brevem minute glandulosum abeuntibus. Folia ovata, anastomosantia, crenata, brevi-pedunculata, 15—33 mm. longa et 10—20 mm. lata, apice obtuso, basi cuneata vel truncata; rarius

subcordata. Bractee lineares, integrae. Cymae simplices vel paulum compositae, bifidae, 5—9 florum. Bracteolae subulato-lineares, pedicello breviores. Pedicelli calyce sesquilingiores. Calycis laciniae glabrae, oblongae, 2 mm. longae, angusto-marginatae. Corolla ignota. Capsula subglobosa, 3 mm. longa, minute apiculata.

S. Turkey: Amanus Mts., Chaklikman, Bithias, by the waterspring, 400—500 m. (27.viii.1931 EZ).

Described from incomplete specimens. The nearest species seems to be *S. antiochia* Post. It is easily discernible from the latter by its leaves which are obtuse and regularly crenate and not acute and irregularly serrate or doubly serrate.

8. *Scrophularia macrophylla* Boiss. Diag. Pl. Or. Nov. Ser. I, 12:32 (1853).

Palestine: LG: Migdal (30.vi.1922 E, Faktorovsky); Yavneel (9.vii.1924 E, Faktorovsky); UG: Wadi Tawahin (6.vi.1926 E Z); HP: Huleh, near Wazieh (27.vii.1924 E, Faktorovsky); Tel-el-Kadi (31.vi.1921 E). Syria: Hermon: Hasbani (19.vii.1924 E); Ain Zbib (21.vii.1924 Smoly); Wadi Shiba'a (11.viii.1929 Gabrielith). Caelesyria: Baalbeck (25.vii.1931 Z). N. Lebanon: Betw. Ehden and the forest of Ehden (21.x.1931 E Z). N. Syria: Daphne near Antiochia (ix.1931 Delbes). S. Turkey: Amanus Mt. ascent to Achagi Zarkoun. (x.1935 Delbes); Env. of Gozne, NW of Mersina (17.viii.1931 E Z). *Iraqian Kurdistan*: Qara-Dagh, env. of the village Qara-Dagh (14.ix.1933 E F).

Everywhere, except in the last locality, where we found it on shady rocks, it grows near water. Boissier and Stiefel-hagen reported this species only from Palestine and Syria. Asia Minor and Iraqian Kurdistan are thus a considerable extension of its area. Within Palestine and Syria it is widely distributed and I suspect that many incorrect data about various *Scrophularia* species of the sect. *Scorodonia* in Palestine and Syria must be traced back to this species.

9. *Scrophularia Nabataeorum* Eig sp. nov.

Plate II.

Biennis, 60—70 cm. alta, tota minute pruinosa, caulibus simplicibus vel ad basin ramosis, foliosis, acute quadrangulis, in thyrsus laxum subpyramidalem abeuntibus. Folia magna, tenera, anastomosantia, oblonga, pedunculata, majora usque 20 cm. longa, pinnatipartita, segmenta oblonga duplice dentata et crenata, terminalia saepe multo majora; folia inferiora et superiora diminuta. Bractee lineares, integrae, superiores valde diminutae. Cymae simplices vel paulum compositae, bifidae, 3—7 florum, pedunculis 15—25 mm. longis suffultae. Bracteolae



subulato-lineares, pedicello multo breviores. Pedicelli calyce 2—4 plo longiores. Calycis laciniae glabrae vel paulum pruinosae, oblongae, 2 mm. longae, albo-marginatae. Corolla glabra, lurida, 6 mm. longa et 4 mm. lata, ad basim vix vel non inflata; stamina longissime exserta; appendix oblonga, parva. Capsula ovata, longe apiculata, 7—9 mm. longa, calyce multo longior.

Palestine: E. Petra (17.iv.1929 E Z; 10.iv.1935 Dinsmore, sub *S. heterophylla* Willd.).

I am undecided as to the affinity of this species. According to its whole habit, large delicate leaves with anastomosed nerves and with long pedicels, it should be placed among the species of the sect. *Scorodonia*, but the leaves are pinnatifid and not entire and the anastomosed nerves are seen very clearly, it is true only when the leaves are looked at against the light. I therefore placed it after the *Scorodonia*-group, just at the beginning of the Section *Tomiophyllum*.

10. *Scrophularia tagetifolia* Boiss. et Haussk. ssp. *diversifolia* Eig ssp. nov.

Biennis, 80—100 cm. alta, glabra, caulibus simplicibus, superne paulum ramosis, obtuse quadrangulis, in thyrsum longum laxuramosissimum abeuntibus. Folia valde variabilia, ambitu oblonga, inferiora saepe profunde lobata usque pinnatipartita, lobis grosse vel minuto, saepe irregulariter, dentatis, interdum lobatis; superiora, 1—2 profunde lobata, irregulariter dentata; summa interdum lanceolata integra, dentata. Cymae 2—5 florum. Bractaeae et bracteolae linearisubulatae. Pedicelli calyce 3—5 plo longiores. Calycis laciniae lato-ovatae, albo-marginatae, 3 mm. longae. Corolla glabra, pallide lurida, 6 mm. longa et 4 mm. lata, lobo superiore longiore; stamina inclusa; appendix reniformis; capsula globosa, 4—5 mm. longa, apiculata.

S. Turkey: Env. of Gozne (NW of Mersina), 1000—1100 m. in a maquis (16.viii.1931 EZ); there, shady rocks (17.viii.1931 EZ); there, in a *Pinetum Brutiae* (16.viii.1931 EZ); there, fields (7.viii.1931 EZ).

It is distinguished from *S. tagetifolia* Boiss. et Haussk. (by comparison with the description of the species) by the few flowered cymes, etc. I did not see any specimens of *S. tagetifolia* and therefore the systematic position of this form is still uncertain.

11. *Scrophularia Michoniana* Cass. et Kral. Cat. Pl. Pal.:13 (1854).

var. *typica*.

Folia pinnatipartita vel pinnatifida vel  $\pm$  lobata; corolla 8—10 mm.

longa, 5—6 mm. lata, flavescens, rarissime rubra; stamina inclusa, rare subexserta, rarissime longo-exserta; membrana calycis laciniae saepissime fusco rubella.

Palestine: J: Hulda (29.iii.1922 *E*, *Faktorovsky*); env. of Zakariah and of Beth-Jamal (14.iv.1928 *E F Z*); Artuf (8.iii.1924 *E*); Deir-esh-Sheikh (20.iv.1925 *E Z*); Kiryat Anavim (21.iii.1924 *E*, *Faktorovsky*). S: Balata (11.v.1927 *E*). LG: Nazareth (7.ii.1923 *E*, *Faktorovsky*). CA: Carmel, near Haifa (iv.1923 *E*, *Faktorovsky*); Wadi Shumrieh (3.v.1928 *EFZ*). EP: Ain Harod (9.iv.1922 *E*, *Faktorovsky*). UG: Rama (2.iv.1927 *EFZ*); Wadi Qurein (30.v.1926 *E Z*); Tel-Hai (i.1922 *E*, *Faktorovsky*). JD: Kefar Natr to Jebel Qarantul (29.iii.1930 *Gabrielith*); env. of Deir-Diwan (29.iii.1930 *F Z*); Wadi Derajeh to Ras Fashkha (26.iii.1926 *E F Z*). J: Mejdal to Jerash (9.v.1927 *E F Z*); Jerash (3.v.1911 *Dinsmore and Meyers*). Syria: Hasbani, on the border of Palestine (iv.1924 *Smoly*); Deir Mumess (17.iii.1925 *Smoly*); Nahr Litani (15.iii.1925 *Smoly*).

var. *tenuisecta* Boiss. Fl. Or. 4:402 (1879). — Syn. S. hierochuntina Boiss.

Folia multum decomposita; corolla purpurea; caetera ut in var *typica*.

Palestine: UG: Mejdal Krum to Rama (3.ii.1927 *EFZ*). Syria: Nahar Dardara, on the border of Palestine (7.iii.1925 *Smoly*).

var. *marginata* var. nov.

Bracteae et bracteolae  $\pm$  marginato-scariosae; caetera ut in var. *tenuisecta*.

Palestine: EP: Tel-Joseph (9.ii.1924 *E*).

var. *splendens* var. nov.

Corolla rubra, magna, 12—14 mm. longa et 7—8 mm. lata; stamina longo-exserta, dense glandulosa; membrana calycis laciniae alba; folia ignota.

Palestine: LJ: env. of Ain Gedi (27.iii.1924 *Z*).

This last variety is very prominent and its systematical rank is probably more than a simple variety, but the material at hand is too poor to allow of a definite decision.

12. *Scrophularia lucida* L. var. *filicifolia* (Mill.) Boiss. — Fl. Or. 4:403 (1879).

N. Syria: Betw. Telejin and Abudhur (5.v.1931 *Z*).

The type of this species must, it seems to me, be excluded from the list of Syrian plants; as for Palestine, neither the type nor the variety grow there.

13. *Scrophularia sphaerocarpa* Boiss. et Reut. — Boiss. Diag. Pl. Or. Nov. Ser. II, 3:158 (1856).

S. Turkey: Amanus Mts., western slope, betw. Karagouz and Bagajak, in a *Pinetum Brutiae* (1.viii.1932 EZ); Achkar Beyli (17.v.1932 Delbes).

Post reports it also from Transjordan, but this record is very doubtful.

14. *Scrophularia telavivensis* Eig sp. nov. Plate II.

Biennis (aut annua?), elata, plus 1 m. alta, caulibus simplicibus foliosis, obtuse quad.angulis, glabris aut sparsim et minute puberulis, in thyrsus elongatum simplicem, subluxum abeuntibus. Folia radicalia oblongo-ovata, longo-petiolata, lobata et crenulata, ca. 3 cm. longa et 2 cm. lata; folia caulina majora, petiolata pinnatisecta vel bipinnatisecta, segmentis obtuso dentatis. Bractee infimae oblongae, pinnatisectae, summae lineares, minutae, integrae. Cymae simplices, bifidae, glabrae vel parte glandulosae, densiflorae, infernae 15—20—florae, summae pauciflorae, pedunculo brevissimo sufultae. Bractee lineari-subulatae, pedicello breviores. Pedicelli calyce sesquilingiores. Calycis laciniae glabrae ovatae, lato-marginatae, 4 mm. longae; corolla glabra, purpurea(?), 7 mm. longa et 4 mm. lata, basi ampliata; stamina inclusa vel vix exserta. Appendix transverse reniformis vel spathulata, apice truncato. Capsula parva, globosa, apiculata calyce vix longior.

Palestine: SH: Shekhunat Borokhov, near Tel-Aviv (15.viii.1928 E).

A pretty species which seems to have in *S. sphaerocarpa* Boiss. et Reut. its nearest relative. It is distinguished from the latter by the leaves, dense flowers borne on longer pedicels, by the short-peduncled cymes, etc.

var. *ithaburensis* var. nov.

Differt ab *S. telavivensis*: biennis, caulibus ramosis; cymae breviores, densiores; capsulae majores.

Palestine: LG: At the foot of Mt. Tabor (15.vi.1932 M. Grinker); Kefar Hahasidim to Carmel (vi.1945 Horowitz).

The relationships between the species and its variety are somewhat obscure and need further observation.

15. *Scrophularia xylorrhiza* Boiss. et Haussk. — Boiss. Fl. Or. 4:406 (1879).

Palestine: E: Wadi Musa and Petra (17.iv.1929 E Z); Wadi Musa village (29.iii.1936 E F Z). Syria: Antiochia (8.v.1931 Z); env. of Hama (12.v.1931 Z).



Boissier described this species on several specimens from Palestine, Syria and Southern Turkey. I examined some of them and found them to be very heterogeneous. Boissier ascribed to his *S. xylorrhiza* "appendix ovato-rotundatus", whereas I found that in our specimens as well as in those of *Haussknecht* from Orfa and Aleppo the appendix is oblong-linear. Did Boissier find specimens with an ovate-rotundate appendix among the numerous specimens, mentioned in Fl. Or. under *S. xylorrhiza*? If this is the case, our specimens and those of *Haussknecht* are not *S. xylorrhiza* but another undescribed species. If not *S. xylorrhiza* must be placed in another group, that of *S. glauca*, with "appendix ovata, oblonga vel oblongo-linearis."

16. *Scrophularia xanthoglossa* Boiss. — Diag. Pl. Or. Nov., Ser. I, 12:38 (1856).

var. *typica* (non var. *genuina* Boiss.)

*Cymae simplices, rare paulum compositae, 3—7 florum.*

Sinai: On the border of Palestine: el-Arish, banks of the Wadi (2.v.1925 *E*). Palestine: N: 10 km. E of Beersheba (24.v.1934 *E F Z*); 70th km. on the Jerusalem—Beersheba road (23.iv.1934 *E F*); betw. Daharieh and Beersheba (23.iv.1934 *E F*). JD: E of Beni Naim, Wadi Ghor (11.v.1934 *E F Z*); between Wadi Rijan and Wadi Siqueh (29.iii.1930 *F Z*); between Wadi Derajeh and Ras-Fashkha (26.iii.1926 *E F Z*); Wadi Shukf to Wadi Sdeir (23.iii.1926 *E F Z*); Kefar Natr to Jebel Qarantul (29.iii.1930 *Gabrielith*); Wadi Shiban (29.iii.1930 *E Z*). JM: env. of Daharieh (4.iv.1927 *E F Z*); ca. 5 km. S of Bethlehem (5.iii.1932 *E F*); Qiryat-Anavim (25.v.1925 *E Z*); Deir-esh-Sheikh (29.xii.1931 *E F Z*). SH: Bashit (3.iv.1927 *E F Z*); Gedera (11.iv.1927 *E F Z*); env of Nes-Tsiona (3.iv.1926 *E F Z*); Rishon-le-Tsion (25.iii.1925 *E*); Tel-Aviv (20.iii.1924 *E*); Ramath-Gan (7.iv.1936 *E*); Shekhunath-Borokhov, (2.iii.1924 *E*). UJ: Betw. Tiberias and Kinnereth (31.x.1926 *E F Z*). UG: Rosh-Pina (6.iv.1924 *E*); Kefar Gileadi (8.v.1925 *Smoly*). E: 7 km. E of Wadi Musa (29.iii.1936 *E F Z*); 13 km. E of Wadi Musa, ca. 500 m. (29.iii.1936 *E F Z*); 23 km. SW of Ma'an (30.iii.1936 *E F Z*). G: Jerash, 530 m. (3.v.1911 *Meyers and Dinsmore*). A: Amman (7.v.1927 *E F Z*); N of Amman (28.x.1926 *E*); es-Salt (20.iv.1929 *E Z*); ascent to es-Salt, 29 km. E of the Jordan (6.v.1927 *E F Z*); above the Yabbok river (2.v.1911 *Meyers and Dinsmore*). Syria: Hasbani (iv.1924 *E*); Wadi Dardara (24.iv.1925 *Smoly*); Antilebanon (3.v.1930 *Warburg*); Homs, the fort of the city (25.vi.1932 *E Z*); Riha (7.v.1931 *Z*); Muslemie (6.v.1931 *Z*); 14 km. W of Hussetché (29.iv.1933 *E Z*). Iraq: 145 km. NE of Deltawah, N of Baghdad (12.iv.1933 *E Z*); 14 km. NE of Kirkuk (13.iv.1933 *E Z*); Jebel Darbin, 69 km. NE of Kirkuk

(13.iv.1933 *E Z*); 11 km. S of Khanaq, N of Mosul (24.iv.1933 *E Z*); 35 km. S of Khanaq, N of Mosul (24.iv.1933 *E Z*); foot of Jebel Bashiqa (NE of Mosul) and betw. Bashiqa and Fadhiliyah (21.iv.1933 *E Z*).

**var. *ampliantha* var. nov.**

*Cymae saepe composito-divaricatae, 9-pluriflorae.*

**P a l e s t i n e:** SH: Betw. Rishon-le-Tsion and Nahlat-Yehuda (25.iii.1925 *E*); betw. Kefar Uria and Hulda (15.iv.1926 *E*); env. of Tel-Aviv, Nahlat-Itshak (7.iv.1936 *E F Z*). JM: Jerusalem (30.iii.1929 *Z*). A: Amman, Amphitheatre (5.iv.1929 *E Z*). Syria: Env. of the village of Jerijir, foot of eastern slopes of the Antilebanon (24.vi.1932 *E Z*); Baalbeck (15.viii.1929 *Gabrielith*); env. of Harmal (v.1931 *Z*); env. of Aleppo (4.v.1931 *Z*); Muslemie (6.v.1931 *Z*); Telejin-Abudhur (5.v.1931 *E Z*). 28 km. W of Selimié (2.v.1933 *E Z*). **S. T u r k e y:** Beilan (8.v.1931 *Z*); Soukluk (10.v.1931 *Z*). **I r a q:** Dohuk (25.iv.1932 *Guest*).

**var. *macrocarpa* var. nov.**

Differt ab var. *ampliantha*: capsula major, 6—7 mm. lata et 5—6 mm. longa. Vix varietas!

**P a l e s t i n e:** JM: Betw. Hulda and Kefar Uria (15.ix.1926 *E*). E: Nebo Mt. (*Gabrielith*). Syria: Env. of Hama (12.v.1931 *Z*).

**var. *deserticola* var. nov.**

20—30 cm. alta, caulibus strictis, glaucis, angulatis; folia multo minora, rigida, suprema saepe subintegra; flores parvi, 4—5 mm. longi.

**S i n a i:** (*A. Kaiser*, 1930, No. 597). **P a l e s t i n e:** E: Wadi Hasa, near Hasa (10.iv.1929 *E Z*); Petra (17.ix.1929 *E Z*). Syria: Betw. Quriatein and Hawarin (24.vi.1932 *E Z*); env. of the village of Jirijir, at foot of eastern slopes of the Antilebanon (24.vi.1932 *E Z*).

A prominent form both morphologically and ecologically, occurring in the driest parts of the Irano-Turanian territories of Palestine and Syria.

In this species the size of the flowers, capsule and of the whole plant is smaller as we proceed from the Mediterranean districts towards inner Syria and Mesopotamia. These small-sized specimens with the smaller flowers form the var. *decipiens* of Boiss. as mentioned in *Fl. Or.* But I am in doubt as to their identity with *S. decipiens* Boiss. et Kotschy. I did not assign these small flowered specimens to a special variety.

Boissier published *S. xanthoglossa* in 1853 on the specimens from Jerusalem. In 1856 he published *S. decipiens* Boiss. et Ky. on the specimens of Kotschy from Cilician Taurus, Metdesis

Mt. at a height of 8500 feet. In the same year he published also *S. hispidula* on the specimens of Balansa from Mersina in the Cilician plain. In the *Flora Orientalis* Boissier reduced the last two species to varieties of *S. xanthoglossa*, a view which has since been accepted by Stiefelhaven, Post, Dinsmore etc. Whereas the type of *S. xanthoglossa* is reported in the *Flora Orientalis* from Jerusalem and Hebron only, the var. *decipiens* (*S. decipiens*) is reported there as widely distributed in Syria, Southern Turkey and Northern Mesopotamia. For var. *hispidula* (*S. hispidula*) Boissier in his *Fl. Or.* did not report any other but the classic locality of Mersina.

In 1888 Post published *S. gileadensis* from Gilead (Trans-jordan) and in 1893 — *S. Peyroni* from Beirut. In the first edition of his *Flora* (1896), Post did not report other localities for *S. gileadensis*, but for *S. Peyroni* he added to the mentioned locality of Beirut that of Antilebanon. Stiefelhaven (1910) reduced *S. gileadensis* and *S. Peyroni* to synonyms of *S. xanthoglossa* and recorded the general distribution of the latter as follows: Egypt, Sinai, Palestine, Syria, Cilicia, Mesopotamia, Armenia, Persia, Transcaspia and he adds: "Eine sehr variable Art, bei der ein Unterscheiden konstanter Formen nicht moeglich ist". Our very abundant material of *Scrophularia* of the group "*xanthoglossa*" enables me to arrive at the following conclusions:

(1) Of the four species, *S. decipiens* Boiss. et Kotschy, *S. hispidula* Boiss. et Bal., *S. gileadensis* Post and *S. Peyroni* Post, reported by Stiefelhaven as synonyms to *S. xanthoglossa*, only one, viz. *S. gileadensis* Post, is certain to be a simple synonym of *S. xanthoglossa*.

(2) *S. Peyroni* Post is a good species well distinguished, both morphologically and ecologically, from *S. xanthoglossa*. Whereas *S. Peyroni* is a true Mediterranean plant, rarely penetrating into the transitional Meditterano-Irano-Turanian districts of Palestine and Syria, *S. xanthoglossa* is principally an Irano-Turanian plant, penetrating into both the Mediterranean and Saharo-Sindian territories.

(3) *S. decipiens* Boiss. et Kotschy is probably also a form of *S. xanthoglossa*. But in order to be sure of this it is necessary to examine new and more numerous material from the Taurus Mountains. I have seen the original specimens from there only. At all events this form is not so widely distributed as is reported by Boissier (1879) and by Post-Dinsmore (1933).

(4) *S. hispidula* Boiss. et Bal. is a dubious species whose position is still uncertain. In *Fl. Or.* (1879) Boissier mentioned for this form only the original specimens published 23 years before. Dinsmore, in the second edition of Post's *Flora*, reported this form from some localities from Palestine also, but this is no doubt due to ill-determined specimens. *S. xanthoglossa* and *S. Peyroni* have both the inflorescence generally somewhat



glandular-pruinose or, sometimes, completely glabrous, but never glandular-hirsute, as is the case with *S. hispidula* Boiss. et Bal. There are other characteristics also peculiar to *S. hispidula* and it is necessary to study fresh material of this form from Cilicia before we can decide upon its taxonomic value.

# 17. *Scrophularia Peyroni* Post. Pl. Post. 5:14 (1893).

Palestine: SH: Betw. El-Qubab and Latrun (27.v.1929 *E F Z*); Mikveh-Israel (26.v.1922 *E*); Petah-Tikva (18.v.1922 *E*); Herzlia (17.vi.1928 *Z*). CA: Carmel, near Haifa (10.v.1923 *E*). EP: Balfouria to Tel-Adashim (24.v.1926 *E*); Kefar Yehzekiel (25.v.1926 *Z*); Kefar Tabor (v.1932 *Grinker*). UG: Banks of Wadi Qurein (30.v.1926 *E Z*); Wadi el-Kuff (30.v.1929 *Gabrielith*); Tarshiha to Peki'in (31.v.1926 *E Z*); Peki'in to Hurfesh (2.vi.1926 *E Z*). Syria: Hauran and Jebel Druz: env. of Bosra-el-Hariri (19.vi.1932 *E Z*); Shiba to Ain Zbib (18.viii.1929 *Gabrielith*); Sueda (15.v.1931 *Z*); env. of Svoura-el-Kebire, near Damascus (21.vi.1932 *E Z*); env. of Chakra, betw. Damascus and Sweida, ploughed wheat fields (19.vi.1932 *E Z*). Antilebanon: Hermon (21.vii.1924 *E*); W slopes of Antilebanon near Baalbeck (25.vii.1931 *E Z*). Lebanon: Mountains above Ehden, ca. 1500 m. (2.ix.1931 *E Z*); W of Wadi Jehennan, betw. Ain-el-Mauzeh and Ain Tafikhe, 1500—1550 m. (11.vii.1934 *E F Z*); Karnita Mt., 1600—1800 m. (12.vii.1934 *E F Z*); Nebi-el-Nassaura to Ain Fissene (17.vii.1934 *E F Z*); betw. Ehden and *Cedrus* forest, 1400—1600 m. (24.vii.1931 *Z*); Talie, above the forest of Ehden, 1700 m. (3.ix.1931 *E Z*); ascent to Jebel Makmel, above Ehden, 1800—1900 m. (24.vii.1931 *E Z*). Inner Syria: Hama (12.v.1931 *E Z*). S. Turkey: Kerkhan to Alexandretta (9.v.1931 *E Z*).

The flower of *S. Peyroni* is easily distinguished from that of *S. xanthoglossa* by its ovate-elliptical and not reniform (broader than long) appendix, by included stamens, by the longer lower and shorter two upper lobes of the corolla, by its small size etc. The two branches of the cyme are transformed into long monochasia bearing 10 —  $\infty$  flowers each.

# 18. *Scrophularia deserti* Del. Fl. Eg. 93 (1813).

Palestine: N: Beersheba to Gaza (x.1926 *E Z*). JD: Takoa to Ain Gedi (13.v.1934 *E F Z*); ascent from Ain Fuar (27.iii.1935 *E Z*; *Grizi*); Talat-et-Dam (19.v.1933 *F*); hills near Hirbet-el-Mird (2.iv.1932 *E F*); halfway between Jerusalem and Jericho (2.iv.1925 *E*). LJ: Arnon (27.x.1926 *E*); Ras-Feshkha to Jericho (27.iii.1926 *E F Z*); Wadi Derajeh to Ras-Feshkha (26.iii.1926 *E F Z*); Bir-Ghuweir to Wadi Shukf (23.iii.1926 *E F Z*); Ain Gedi to Wadi Derajeh (25.iii.1926 *E F Z*); Ez-Zuweira (15.iii.1912 *Meyers* and *Dinsmore*); env. of Ras Zuweira (11.i.1926 *Z*); Massada (26.iii.1929 *Gabrielith*). AR: Wadi-el-Araba,

5 km. of Ain Husb (4.iv.1936 E F Z). Iraq: Rowanduz (16.v.1930 *Guest*); 29 km. NW of Kirkuk (16.iv.1933 E Z); 12 km. NW of Kirkuk (16.iv.1933 E Z); Jebel Hamrin (12.iv.1933 E Z); Chia-i-Mandali Mt., Rowanduz area (25.vii.1932 *Guest*); Wadi Muhammadi, 70 km. W of Ramadi, 190 km. of Baghdad (2.iv.1933 E Z); betw. at-Tuba and ar-Rumail (8.iv.1933 E Z); 29 km. SW of az-Zubair, S of Basra (8.iv.1933 E Z); env. of Kuwaibda, 35 km. of Basra plain (8.iv.1933 E Z).

var *foliata* var. nov.

*Folia* toto cauli obsita, conformia, crenata aut lobata.

Northern Iraq: Env. of Khanaq (N of Mosul) near Pesh Khabur, sandy soil (24.iv.1933 E Z).

19. *Scrophularia marginata* Boiss. — *Diag. Pl. Or. Nov. Ser. I*, 4:72 (1844).

Iraq: Baba Gurgur near Kirkuk (8.vii.1933 *Guest*); Ghurfā plain (7.vii.1933 *Guest*).

20. *Scrophularia pruinosa* Boiss. ssp. *iraquensis* Eig ssp. nov.

Biennis, 40—50 cm. alta, caulibus e basi ramosis, inferne pruinoso-farinosis, quadrangulis, in inflorescentiam laxifloram, longam, aphyllam abeuntibus. Folia sparsa, solum ad partem caulis inferiorem, inferiora petiolata, superiora subsessilia, punctata et pruinoso-farinosa, ovata, grosse crenato-lobata, basi interdum lacinulis 1—2 auctis. Cymae parce glandulosae, crassiusculo-petiolatae, bifidae vel simplices, 3—5 florae. Bracteolae lanceolato-lineares, pedicello breviores. Pedicelli calyce breviores vel subaequales. Calycis laciniae lato-ovatae usque orbiculatae, 3 mm. longae, membranaceae, membrana denticulata, laciniiis multo angustior. Corolla glabra urceolata, pallide lurida, 7—8 mm. longa; antherae paulum exsertae; appendix linearis, apice non dilatata. Capsula globosa, 4—5 mm. longa, longo-apiculata.

Iraq: Jabal E.-NE. of Sari Hasan Beq, on the stony hillside, 2200 m. (24.vii.1932 *Guest*, sub *S. pruinosa* Boiss.); Mt. Marmarut (Rowanduz), 1200 m. (19.iv.1932 *Guest*; young specimen).

It is distinguished from *S. pruinosa* Boiss. by the linear appendix, by the narrower margin of the calyx lobes, bigger flowers, etc. I could not obtain specimens of *S. pruinosa* for comparison and so the systematic position of this form, as in the case of *S. tagetifolia* ssp. *diversifolia*, is still doubtful.

21. *Scrophularia libanotica* Boiss. — *Diag. Pl. Or. Nov., Ser. I*, 12:36 (1853).

Syria: Hauran and Jebel Druz: Jebel Qalyeb (21.v.1933 *Dinsmore*, sub *S. peregrina* L.). Antilebanon: Hermon (22.vii

1924 E); above Jebel el-Kara, near Damascus (22.vi.1932 E Z). Lebanon: *Cedrus* forest above Ehden (24.viii.1931 Z); above Bscheria (21.vii.1931 Z); betw. the forest of Ehden and the forest of Bscheria (3.ii.1931 E Z); Kornet-es-Sauda (3.ix.1931 E Z); Jebel Karnita (12.vii.1934 E F Z). S. Turkey: Taurus Mts., Bulgardagh, betw. Bozanti and Ak-Koepru bridge (21.viii.1931 E Z); descent from the summit of Armadshek towards Schauscha (21.viii.1931 E Z); ascent from Schauscha to Sarubey (22.viii.1931 E Z); top of Sarubey Mt. (22.viii.1931 E Z). Iraqi Kurdistan: Qara-Dagh, Kanitacht, in a *Quercetum persicae* (10.ix.1933 E F Z); env. of the village Sarsink (26.ix.1933 F); Pir-i-Mukurun Dagh (19.ix.1933 E Duvdevani).

22. *Scrophularia hypericifolia* Wydl. — Mem. Soc. Phys. Genève 4:166 (1898). — Syn. *S. syriaca* Benth. (1846).

Sinai: El-Arish (1.v.1925 E). Palestine: CN: Rafah dunes (29.iv.1925 E); Gaza (3.v.1924 E, Faktorovsky). SH: Rishon-le-Tsion (25.iii.1925 E); Tel-Aviv (18.xii.1923 E, Faktorovsky).

Dinsmore, in the second edition of Post's Flora, reports *S. hypericifolia* and *S. syriaca* as two separate species, which is certainly wrong. The statement of Bové (in Boissier) that this plant grows in Palestine near Nazareth is incorrect too. In Mediterranean Palestine this species grows only in the dunes of the coastal plain, where, along with many other Saharo-Sindian plants, it forms a kind of edaphic Saharo-Sindian enclave in the pure Mediterranean climatic territory.

This revision was, thus concerned with 9 species from Palestine, 12 from Syria, 8 from Iraq and 4 from Southern Turkey.

Those from Palestine are: *S. macrophylla* Boiss., *S. Nabateorum* Eig sp. nov., *S. Michoniana* Cass. et Kral., *S. telavivensis* Eig sp. nov., *S. xylorrhiza* Boiss. et Haussk., *S. xanthoglossa* Boiss., *S. Peyroni* Post, *S. deserti* Del., *S. hypericifolia* Wydl.

Those from Syria are: *S. peregrina* L., *S. Scopolii* Hoppe, *S. antiochia* Post, *S. clematidifolia* Eig sp. nov., *S. macrophylla* Boiss., *S. Michoniana* Cass. et Kral., *S. lucida* L., (only var *filicifolia* Boiss.), *S. sphaerocarpa* Boiss. et Reut., *S. xylorrhiza* Boiss. et Haussk., *S. xanthoglossa* Boiss., *S. Peyroni* Post, *S. libanotica* Boiss.

Those from Iraq are: *S. Guestii* Eig sp. nov., *S. kurdica* Eig sp. nov., *S. macrophylla* Boiss., *S. xanthoglossa* Boiss., *S. deserti* Del., *S. marginata* Boiss., *S. pruinosa* Boiss. ssp. *iraquensis* Eig ssp. nov., *S. libanotica* Boiss.

Those from Southern Turkey are: *S. Kotschyana* Bth., *S. macro-*



*phylla* Boiss., *S. tagetifolia* Boiss. et Haussk. ssp. *diversifolia* Eig ssp. nov., *S. libanotica* Boiss.

Stiefelha gen (1910) also reports for Palestine *S. peregrina* L. This is certainly incorrect. Post (1896) and Post-Dinsmore (1933) reported for Palestine the following species not represented in our Herbarium: *S. alata* Gilib., *S. lucida* L., *S. sphaerocarpa* Boiss. et Reut., *S. heterophylla* Willd., *S. variegata* M.B., *S. canina* L. The first, second, fourth, fifth and sixth of these are no doubt attributed to Palestine owing to incorrect determination<sup>1</sup>. I am also very sceptical as to whether Post really found *S. sphaerocarpa* in Trans-jordan. So the list of the Palestine *Scrophularia* species consists, according to this revision, of 9 species.

For Syria Stiefelha gen reports, besides those mentioned above, the following 5 species: *S. nusairiensis* Post., *S. alata* Gilib., *S. scariosa* Boiss., *S. tagetifolia* Boiss. et Haussk., *S. hypericifolia* Wydler. Post and Post-Dinsmore add to this *S. variegata* M.B., and Handel-Mazzetti — *S. nodosa* L. Of these *S. alata*, *S. hypericifolia*, *S. variegata* and *S. nodosa* are sure to have been wrongly determined. *S. alata* var. *cordata* Boiss. from Syria is probably *S. pisidica* Boiss. et Held. *S. nusairiensis* is endemic in Syria and *S. scariosa* is principally a Syrian plant. Finally, *S. tagetifolia* also seems to be chiefly a Syrian plant. So the list of Syrian *Scrophularia* includes besides the 12 species mentioned by me, the following: *S. nusairiensis* Post, *S. pisidica* Boiss. et Held., *S. scariosa* Boiss. and *S. tagetifolia* Boiss. et Haussk., altogether 16 species.

For Iraq Stiefelha gen reports *S. alata* Gilib., *S. mesopotamica* Boiss., *S. rimarum* Bornm. and *S. xylorrhiza* Boiss. et Haussk., which are not included in my list. Of these *S. alata* is certainly not an Iraqi plant. *S. mesopotamica*, which is known only by the original specimens from between Orfa and Sewerek is thus a Turkish and not Iraqi species and must be excluded from the list of Iraqi plants. The list of known Iraqi *Scrophularia* thus comprises 10 species for the moment.

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<sup>1</sup> I may mention the instance of *S. lucida* L. var. *flicifolia* (Mill.) Boiss., which is reported from Jericho (leg. et det. Bornmueller). I examined this specimen and found it to be a form of *S. deserti*. Or the case of *S. lucida* L., which is reported "from Hebron to Jerusalem" (leg. et det. Post) and which I found to be *S. Michoniana*.

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# MATERIAUX POUR LA FLORE ALGOLOGIQUE DE LA PALESTINE

## I. LES CYANOPHYCEES

Par T. RAYSS

(Avec 5 figures dans la texte)

*Dédié à la mémoire du Dr. P. Frémy*

### INTRODUCTION

La Palestine, grâce à sa position géographique et à l'extrême variabilité de climat et de sol qu'elle présente sur une superficie relativement restreinte, a attiré de tous temps l'attention des botanistes. Aussi l'étude de sa flore et de sa végétation est très avancée en ce qui concerne les plantes supérieures. Il n'en est malheureusement pas de même pour les plantes inférieures: leur étude a été jusqu'à présent fort négligée et nos connaissances à leur sujet sont encore très limitées. Une heureuse exception présentent toutefois les champignons. Les champignons de la Palestine ont été étudiés par un certain nombre de Mycologues et de Phytopathologistes et continuent à faire objet de nombreuses recherches systématiques, physiologiques, biologiques et phytogéographiques. Nous avons donné antérieurement (Savulescu T. et Rayss T., 1935, *Ann. Cryptog. exot.* 8: 49—87) un aperçu sur tout ce qui a été publié jusqu'alors sur les champignons de la Palestine. Presque tous les travaux qui ont paru depuis ont été publiés dans le *Palestine Journal of Botany*, séries de Jérusalem et de Rehovot.

Sur les lichens on trouve ci et là des indications isolées dans les travaux plus anciens sur la flore de la Palestine. Depuis 1936 paraissent des publications de I. Reichert consacrées spécialement à la systématique et à la répartition phytogéographique des lichens de la Palestine et des pays avoisinants.

Quant aux mousses, à l'exception de quelques énumérations partielles dans les flores plus anciennes, nous ne trouvons qu'une seule publication qui leur soit consacrée, c'est celle de Rabinowitz-Sereni D. (1931): *Contributio alla Briologia della Palestina* (*Annali di Botanica*, 19, f. 2: 1—7). Ce groupe important des plantes attend encore son spécialiste.

Un peu plus avancée est l'étude des algues. Dans des flores plus



anciennes des indications sur les algues sont rares et accessoires. Ainsi nous trouvons chez Strand (1756), une indication sur trois algues de la Mer Rouge; plus tard, paraît un ouvrage de grande valeur de Zanardini (1858) où sont décrites et en partie dessinées de nombreuses algues récoltées à Akaba. Petit (1883) donne une liste de 40 espèces de Diatomées du lac de Tibériade; Brun (1883) ajoute à cette liste quatre "Desmidiées du lac de Tibériade" dont trois sont des *Protococcales*. Hart (1891) signale le *Chara hispida* Linn. à Ayûn Buweidh, Wâdy 'Arabah. Barrois (1894) indique le *Ceratium hirundinella* dans le plancton du lac de Tibériade et *Glenodinium* et *Chara* dans le lac de Houléh.

Ces dernières années l'étude des algues a été reprise en Palestine mais jusqu'à présent rien n'a été publié qui puisse donner une idée d'ensemble sur la flore algologique de notre pays. Les travaux suivants ont paru :

1. Carmin Jos. (1934). Algae of Palestinian Shores. *Bull. Inst. Océanogr. Monaco*, No. 653: 1—7. C'est une énumération d'une trentaine d'algues marines suivie de quelques considérations sommaires sur leur biologie et leur écologie.
2. Frémy P. et Rayss T. (1938). Algues des sources thermales de Kallirrhoe (Transjordanie). *Pal. Journ. Bot. J Series* 1: 27—34. Dans ce travail sont étudiées 17 espèces d'algues appartenant aux Cyanophycées. Quatre algues sont dessinées.
3. Rayss T. et Katchalsky Ephr. (1938). Sur le plancton du lac Houleh. *Hateva ve-Haaretz*, (en hébreu), 24 algues planctoniques y sont dessinées.
4. Rayss T. (1941). Sur les Caulerpes de la côte Palestinienne. *Pal. Journ. Bot. J Series* 2: 103—124. C'est une étude systématique, écologique et phytogéographique de trois espèces de *Caulerpa* trouvées par nous en Palestine suivie de la revue de toutes les caulerpes méditerranéennes; avec 10 figures dans le texte.

En plus quelques algues ont été trouvées par B. Elazari-Volcani dans les eaux et dans les sédiments de la Mer Morte et ont été indiquées dans ses travaux suivants :

5. Elazari-Volcani (Wilkansky) B. (1936). Life in the Dead Sea. *Nature* 138: 467. Dans cette petite note l'auteur signale la présence du *Dunaliella* dans les eaux de la Mer Morte.
6. Elazari-Volcani B. (1940). Studies on the Micro-

- flora of the Dead Sea. Jérusalem (en hébreu, avec un résumé en anglais). 26 algues y sont indiquées et dessinées.
7. Elazari-Volcani B. (1940). Algae in the Bed of the Dead Sea. *Nature* 145: 976. C'est un petit article sur les procédés employés par l'auteur pour mettre en évidence la présence des algues dans les sédiments de la Mer Morte; avec 4 microphotographies. Il est fort probable que les algues indiquées dans cette note ne vivent effectivement pas au fond de la Mer Morte mais y ont été amenées par des affluents.
  8. Elazari-Volcani B. (1944). A Ciliate from the Dead Sea. *Nature* 154: 335. L'auteur y cite un *Aphanocapsa* et la *Dunaliella viridis* Teod.

En plus, dans un travail qui est actuellement sous presse, Elazari-Volcani décrit les cultures pures de sept algues qu'il a obtenues des endroits divers de la Mer Morte, à la surface et dans la profondeur de ses eaux. Ce sont: *Chlorella* sp. (se développe bien dans la concentration de 2% de sel marin); *Phormidium tenue* (Menegh.) Gom. (2%—9% de sel); *Plectonema Nostocorum* Born. (ca. 8% de sel); *Nostoc Muscorum* B. et F. (2%—8% de sel); (ces trois dernières algues ont été déterminées par F. Drouet, Chicago); *Aphanocapsa litoralis* Hansgirg (3% et jusqu'à la saturation complète par le sel) et *Dunaliella viridis* Teod. (16% et jusqu'à la saturation complète par le sel). Les deux derniers organismes sont des halophytes obligatoires et sont fréquents dans la Mer Morte aux différents endroits et à de profondeurs différentes.

Nous même, nous avons déterminé quelques algues récoltées par le distingué botaniste A. Aaronsohn en Cis- et Transjordanie et ces déterminations paraîtront dans les publications correspondantes. Une grande partie de ces algues sont des Characées. Enfin, quelques algues marines sont indiquées incidemment dans la publication de A. Bursa (1944) "On camouflaging of Crabs," *Przyroda. Palestine* (en polonais, avec un résumé en anglais).

Le présent travail est un rapport sur l'ensemble des algues que nous avons récoltées en Palestine, dans des stations les plus variées et à de différentes saisons. Nous avons effectué un certain nombre de pêches planctoniques dans les lacs de Houleh et de la Tibériade, dans le Yarkon, dans la Méditerranée en face du rivage palestinien et dans de nombreux bassins de pisciculture, étangs artificiels destinés à l'élevage des carpes. Les algues des sources thermales ont été récoltées aux environs de la Mer Morte (Kallirrhoe, Zerka) et du lac de la Tibériade (thermes de Tibériade et de Ain-Hamma). Un

grand nombre d'algues provient de la région marécageuse des environs de Hedera et des marécages de Houleh; d'autres ont été récoltées au Nord de la Palestine, aux sources de Jourdain ou bien au Sud du pays, dans de nombreux petits ruisseaux à cours d'eau lent ou rapide des environs de Sodom, au Sud de la Mer Morte. Une attention particulière a été accordée aux algues se développant dans de petits bassins où se trouvent les larves d'*Anopheles* en rapport avec l'écologie des larves d'*Anopheles* en Palestine (nous remercions M. Soliternik pour le matériel et les données mis en notre disposition). Enfin la plupart de nos algues ont été récoltées aux environs de Jérusalem, de Tel-Aviv et de Haifa, dans de petits bassins artificiels, des flaques d'eau et des fossés de la route pendant la saison pluvieuse. Particulièrement intéressantes et riches en récoltes algologiques sont des collections d'eau temporaires dans les calcaires dolomitiques entre Jérusalem et Beth-Hakerem. Entre de grands blocs rocheux qui y parsèment le terrain dans un désordre pittoresque, se trouvent de nombreuses petites dépressions où s'accumulent pendant la saison des pluies des eaux de précipitation, en formant des flaques et des mares plus ou moins étendues et plus ou moins profondes. Toutes ces eaux s'assèchent progressivement à la fin du printemps et aucune pluie ne vient humecter en été le fond de ces dépressions; l'insolation est forte dans cette saison et la température élevée. Quelques algues seulement peuvent s'accomoder à des conditions d'existence aussi particulières et la sécheresse peut y durer 7 à 8 mois par année. Aussi trouvons nous dans ces collections d'eau un petit nombre d'espèces d'algues qui atteignent une densité remarquable: peu d'espèces, beaucoup d'individus. Nous avons confié à notre élève, I. Eig-Faktorith, l'étude biologique et écologique de quelques espèces les plus fréquentes de ces eaux temporaires et les résultats de cette recherche paraîtront prochainement.

Enfin, les algues marines ont été recueillies le long de la côte palestinienne de la Méditerranée.

Les algues qui font l'objet de ce travail ont été étudiées autant que possible à l'état vivant et les récoltes les plus intéressantes ont été conservées au formol. Quelques espèces de *Protococcales* ont été isolées en culture pure d'après la méthode de R. Chodat et ces cultures se trouvent au Département de Botanique à l'Université Hébraïque de Jérusalem.

La première partie de notre travail comprend les Algues Bleues et contient 60 espèces appartenant à huit familles différentes. Nous dédions cette partie à la mémoire de l'Abbé P. Frémy, l'illustre



Algologue Français, qui a péri tragiquement pendant le bombardement de Saint-Lô.

Les parties suivantes sont en préparation et paraîtront successivement et dans l'ordre systématique dans les bulletins à venir de ce même journal.

Nous tenons à exprimer ici notre reconnaissance à tous ceux qui nous ont apporté des algues, vivantes ou conservées, de différents endroits de Palestine, en nous facilitant ainsi nos recherches.

Pour faciliter l'orientation dans de nombreuses localités que nous citons dans ce travail, nous avons adopté les abréviations utilisées dans les autres travaux publiés dans ce journal. AP=Acre Plain; CA=Carmel; CS=Coastal Plain of Shephela; EP=Ezdraelon Plain; G=Gilead; HP=Huleh Plain; J=Judean Mountains; JD=Judean Desert; LG=Lower Galilee; LJ=Lower Jordan Valley; S=Sharon; UG=Upper Galilee; UJ=Upper Jordan Valley. Les chiffres romains suivant les localités indiquent les mois quand l'algue en question a été récoltée dans la localité correspondante. L'astérisque précédant le nom d'espèce indique que cette espèce a été déjà signalée par nous dans le travail: Fr é m y P. et R ā y s s T., Algues des sources thermales de Kallirrhoe (Transjordanie). *Pal. Journ. Bot. J Series* 1:27—34 (1938).

## PARTIE SYSTEMATIQUE

### I. SCHIZOPHYCEAE COHN (CYANOPHYCEAE SACHS, MYXOPHYCEAE WALLR.)

#### I. CHROOCOCCALES

Fam. *Chroococcaceae*

- \*1. *Chroococcus turgidus* (Kütz.) Naeg., Gatt. einzell. Alg.:46 (1849)=*Gloeocapsa turgida* (Kütz.) Holleb. emend. Elenkin:211 (1938). Fig. 1, a et b.

Diam. des cellules: 18—26  $\mu$ ; téguments lamelleux incolores.

AP: étang dans la baie de Haifa, VIII; ruisseau près de Nesher (station d'*Anopheles superpictus*), XI; S: canal creusé pour l'assèchement de Birket-Ata près de Hedera, III; CS: mare à eau saumâtre à Bath-Yam, X; LJ: Kallirrhoe, source thermale (température de l'eau=40°), III.

- \*2. *Chroococcus minutus* (Kütz.) Naeg., Gatt. einzell. Alg.:46 (1849)=*Gloeocapsa minuta* (Kütz.) Kollerm. ampl. Elenkin:233 (1938).

Diam. des cellules: 6—10  $\mu$ , téguments non lamelleux.

AP: étang dans la baie de Haifa, IX; ruisseau près de Nesher (station d'*Anopheles superpictus*), XI; CA: ouadi près de Dahlia, XI; fossé près de Kefar Hassidim, T°=25°, pH=7), VII; G:

Yarmouk, VIII; CS: mare à eau saumâtre à Bat-Yam, X; LJ: Kallirrhoe, source thermale ( $T^{\circ}$  de l'eau =  $40^{\circ}$ ), III.

3. *Gloeocapsa crepidinum* (Rabh.) Thur. in Bornet et Thuret, Notes Alg.:1-3, T. I., fig 1-4 (1876).

Thalle gélatineux, assez mou, olivâtre; diam. des cellules sans tégu-  
ments: 7-8  $\mu$ ; les téguents sont de couleur jaune-brunâtre (section  
*Chrysocapsa* Elenkin), non lamelleux.

CS: mare à eau saumâtre à Bath-Yam, III.

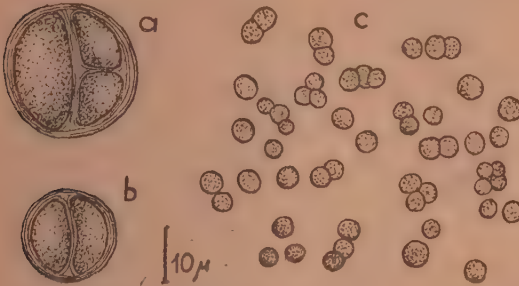


Fig. 1: a et b: *Chroococcus turgidus* (Kuetz.) Naeg.,  
des environs de Hedera. c: *Aphanocapsa pulchra*  
(Kuetz.) Rabenh. Plancton du lac Houleh.

4. *Aphanocapsa pulchra* (Kütz.) Rabenh., Fl. Eur. Alg. 2:49  
(1865). Fig. 1 c.

Cellules 4-4,8  $\mu$  de diam., formant un thalle muqueux aux  
téguents indistincts.

HP: lac de Houleh, IV; LG: lac de Tibériade, I. Dans ces deux  
stations cette algue forme des masses grumeleuses sur les pierres ou  
bien flotte librement à la surface de l'eau.

5. *Aphanocapsa litoralis* Hansgirg (?). K. Boehm. Ges.  
Wiss.:229 (1892).

Dimension des cellules: 9-14,5  $\times$  4-6,3  $\mu$ .

Cet organisme formé par des cellules isolées ou gémées, pauvres  
en contenu ou remplies d'un contenu granuleux, a été trouvé par  
B. Elazar-Volcani dans la vase de la Mer Morte, à  
30 mètres de profondeur, et a été ensuite multiplié dans des cultures  
artificielles. Il a été dessiné par Elazar-Volcani (1940,  
plate III, fig. 5).

- \*6. *Aphanocapsa thermalis* Brügg., Bündner Algen:224 (1863).

Cellules de 3  $\mu$  de diam. en moyenne, formant des colonies denses  
et sans forme définie.

LJ: Kallirrhoe, III, entre les touffes calcaires et des masses d'algues  
qui tapissent les petits cours d'eau thermales dont la  $T^{\circ}$  peut s'élever  
jusqu'à  $40^{\circ}$ .

- \*7. *Gloeotheca Goepfertiana* (Hilse) Forti, Syll. Myxoph.:62 (1907).

Cellules de 2,5—5,5  $\mu$  de diam., à téguments lamelleux.

LJ: Kallirrhoe, III, entre les masses d'algues bordant les sources chaudes.

- \*8. *Gloeotheca rupestris* (Lyngb.) Born. in Wittr. et Nordst., Alg. exs. No. 399 (1880) = *Anacystis rupestris* (Lyngb.) Drouet et Daily.

Dimension des cellules: 12—14  $\times$  5  $\mu$ ; colonies formées d'un petit nombre de cellules (4—8), à téguments peu lamelleux.

LJ: Kallirrhoe, III. Petite source chaude dont l'eau avait 40° C.

9. *Synechocystis aquatilis* Sauv., Bull. Soc. Bot. France, 39:71, tab. VI, fig. 2 (1892).

Diam. des cellules: 5—6  $\mu$ .

HP: lac de Houleh, XII. Cette espèce a été trouvée et décrite par S a u v a g e a u en Algérie, a été signalée aussi en Californie (*Phyc. Bor. Americ.* No. 1206) et en Russie (E l e n k i n, 1938:27). Elle se trouve dans des eaux stagnantes ou thermales et d'après Elenkin, serait à rechercher en Europe occidentale.

10. *Microcystis aeruginosa* (Kütz.) -Elenk., Monogr. Alg. Cyanoph. URSS:100 (1938). Fig. 2, a-d.

Cellules de 3—7  $\mu$  de diam., pourvues de pseudovacuoles.

- f. *aeruginosa* (Kütz.) Elenk. = f. *typica*. Fig. 2 a.

Téguments des colonies peu visibles; colonies plus ou moins rondes ou peu allongées, clathrées ou réticulées.

LJ: bassin de pisciculture à Beth-Arava, I, leg. A. Vershubski; HP et LG: plancton des lacs Houleh et Tibériade, en abondance en hiver, formant à Houleh au mois de mars presque une floraison d'eau.

- f. *flos-aquae* (Wittr.) Elenk. Fig. 2 b.

Mêmes caractères, colonies compactes, non clathrées ou indistinctement perforées, d'un vert pâle.

HP: plancton du lac Houleh, XII—II; LG: plancton du lac de la Tibériade, IX—I; bassins de pisciculture dans les vallées d'Esdraélon, de Jourdain et de Houleh, formant souvent des fleurs d'eau, VII.

- f. *marginata* (Menegh.) Elenk. Fig. 2 c.

Téguments des colonies bien visibles, colonies simples.

HP: plancton du lac Houleh, XII—IV.

- f. *viridis* (A. Br.) Elenk. Fig. 2 d.

Téguments des colonies bien visibles, colonies composées, c. à d. quelques colonies simples sont dans une enveloppe muqueuse commune.

HP: plancton du lac Houleh, en hiver.



11. *Microcystis pulverea* (Wood) Elenk. comb. nov.. Monogr. Alg. Cyanoph. URSS:117 (1938). Fig. 2 e.

Cellules sans pseudovacuoles, colonies ayant une forme plus ou moins définie, sphérique, elliptique ou allongée. Diam. des cellules: 0,3—3  $\mu$ .

HP: plancton du lac Houleh, XII.

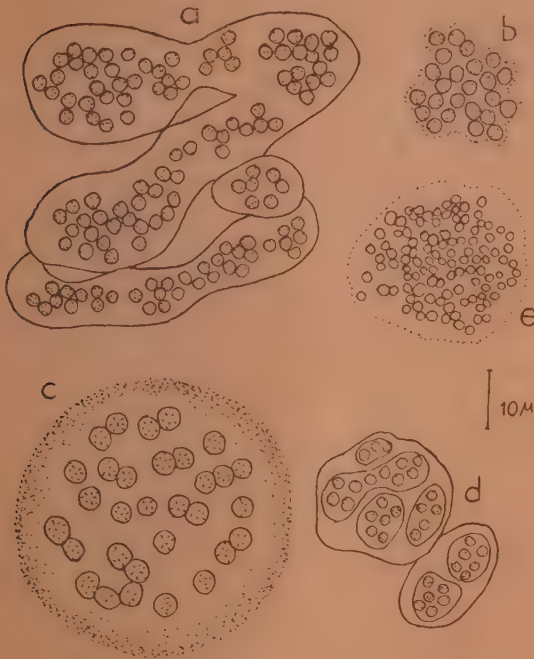


Fig. 2: Les *Microcystis* du lac Houleh.

a—d: *Microcystis aeruginosa*. (Kuetz.) Elenk.

(a) f. *aeruginosa*=f. *typica*; (b) f. *flos-aquae*;

(c) f. *marginata*; (d) f. *viridis*.

e: *Microcystis pulverea*.

12. *Pseudoholopedia convoluta* (Bréb.) Elenk., Monogr. Alg. Cyanoph. URSS:86 (1938)=*Merismopedia convoluta* Brébisson.

Cellules elliptiques-allongées, 8—10×4—5  $\mu$ , formant des colonies quelquefois visibles à l'œil nu (jusqu'à quelques millimètres de diam.), recourbées au bord.

S: cours d'eau Alexandre près du Kefar Vitkin, entre les algues filamenteuses, III; Birket-Ata près de Hedera, III; HP: lac de Houleh, XII.

13. *Merismopedia elegans* A. Br. in Kütz., Sp. Alg.:472 (1849).

Dimensions des cellules:  $5-9 \times 5-7 \mu$ ; les cellules sont sphériques ou légèrement elliptiques formant de grandes colonies carrées ou rectangulaires.

HP: plancton du lac Houleh, XII; S: petite mare à côté du Yarkon près Herzliah, III.

\* 14. *Merismopedia punctata* Meyen, Wieg. Arch., 2:67 (1839).

Cellules de  $2,5-3 \mu$  de diam., plus ou moins sphériques, formant généralement de petites colonies à 8 ou 16 cellules (dans nos exemplaires).

CA: ouadi Melah près du Kefar Hassidim, VII; Tel-Rhain, V; S: fossés près de Hedera, III; UJ: plancton du lac de Tibériade, VI; G: Yarmouk, VIII; LJ: Kallirrhoe, III, petit cours d'eau à  $T^{\circ}=35^{\circ}$ .

15. *Merismopedia glauca* (Ehrenb.) Naeg., Gatt. einzell. Alg.:55, pl. I. D. (1849).

Diam. des cellules:  $4-5 \mu$ ; petites colonies denses d'un vert glauque ou olivâtre.

HP: plancton du lac Houleh, en hiver.

16. *Merismopedia tenuissima* Lemmerm., Bot. Ctrbl. 76:154 (1898).

Cellules subsphériques,  $1,5-2 \mu$  de diam., formant des colonies rectangulaires à cellules densément rapprochées.

AP: petit étang dans la baie de Haifa, VII; CS: mare à eau saumâtre à Bath-Yam, X.

17. *Gomphosphaeria aponina* Kütz., Alg. exsicc., No. 151 (1836), f. *limnetica* (Vir.) Elenk.

Cellules piriformes ou cunéiformes,  $8-10 \times 4-5 \mu$ , disposées sur de courts pédicelles rayonnant du centre de la colonie.

LJ: Ain-Feshkha; mare à eau saumâtre, en très grande quantité, XII. Récolté par A. Vershubski.

D'après L. Gauthier-Lièvre (1931, p. 221) cette espèce croît en Algérie "de préférence dans les eaux saumâtres, ou, tout au moins, dans des eaux fortement chargées en sels de magnésie".

## II. CHAMAESIPHONALES

### Fam. *Pleurocapsaceae*

18. *Pleurocapsa minor* Hansg. emend. Geitl., Cyanoph.:128 (1925).

Diam. des cellules:  $5-8 \mu$ . Status mucosus. Forme un enduit d'un vert violacé sur les rochers humides.

J: Silouan, rochers suintants, I.

III. HORMOGONEALES

A. Homocysteeae

Fam. *Oscillatoriaceae*

19. *Oscillatoria amphibia* Ag., Flora, X:632 (1827); Gom., Monogr., II:241, pl. VII. fig. 4—5 (1893).

Trichomes minces, 2—3  $\mu$  de diam., aux cellules plus longues que larges, 4—6  $\mu$  de longueur, longuement arqués vers l'extrémité, gardant le même diamètre dans tout leur parcours, non capités, fragiles, sans rétrécissements au niveau des articulations mais pourvus presque constamment de deux granules à côté de cloisons.

UJ: forme une espèce de fleur d'eau dans un bassin de pisciculture à Messiloth, VIII. Dans la vase de ce même étang cette algue forme des masses étalées.

- \*20. *Oscillatoria chalybea* Martens in Jürgens, Alg. aquaticae, dec. XIII, No. 4 (1822); Gom., Monogr. 2:252, pl. VII, fig. 19 (1893).

Diam. des cellules: 9—12  $\mu$ ; trichomes légèrement rétrécis au niveau des articulations, au sommet à peine atténué-unciné; cellule apicale obtuse.

LJ: Kallirrhoe, entre les masses muqueuses d'algues au bord d'une source thermale, III.

- \*21. *Oscillatoria formosa* Bory. Dict. class. d'hist. nat. 12:474 (1827); Gom., Monogr. 12:250, pl. VII, fig. 16 (1893).

Diam. des cellules: 4—6  $\mu$ ; trichomes légèrement rétrécis au niveau des articulations, non capités; protoplasma fortement granuleux; sommet des trichomes courbé-unciné.

LJ: Kallirrhoe, ruisseau d'écoulement d'une source chaude, T° de l'eau=35°, III.

22. *Oscillatoria Mougeotii* Kütz. apud Geitler, Cyanoph.:362 (1925).

Diam. des cellules: 5—7  $\mu$ ; longueur des articles: 2—3  $\mu$ ; pseudovacuoles nombreuses. Trichomes non rétrécis au niveau des cloisons, droits ou faiblement courbés, à cellule terminale largement arrondie.

UJ: Kinnereth, bassin de pisciculture, formant en juillet la fleur d'eau. Geitler (l.c.) dit que cette algue est "anfängs auf Schlamm festsitzend, später planktonisch". Dans l'éprouvette notre algue a formé un anneau très épais près de la surface du liquide et un dépôt au fond. Dans le dépôt du fond les trichomes sont partiellement dépourvus de pseudovacuoles; dans la région de l'anneau qui correspond à la fleur d'eau les cellules sont bourrées de pseudovacuoles. Mais par ci par là on trouve des portions des trichomes où les pseudovacuoles manquent. Ces endroits ressortent par vive opposition sur les autres et laissent voir d'une façon évidente que les trichomes ne sont pas rétrécis au niveau des articulations.



23. *Oscillatoria princeps* Vauch., Hist. des Conf.:190, pl. XV, fig. 2 (1803); Gom., Monogr. 2:226, pl. VI, fig. 9 (1893).

Articles très courts, 4—5  $\mu$  de longueur, 35—38  $\mu$  de diam. Trichomes non rétrécis au niveau des cloisons, aux extrémités un peu courbées ou subcapitées.

AP: petit étang dans la baie de Haifa, VIII; J: Kiryath-Anavim, petite mare, entre les *Spirogyra*, VIII; LJ: Ain-Feshkha, marécage aux eaux saumâtres, I.

24. *Oscillatoria proboscidea* Gom., Monogr. 2:229, pl. VI, fig. 10—11 (1893). Fig. 3.

Articles très courts, 12—14  $\mu$  de diam., 2—4  $\mu$  de longueur, rétrécis au niveau des articulations. Trichomes non uncinés à leur extrémité, au sommet presque tronqué, capité.

CS: bords du Yarkon, à son embouchure, III.

25. *Oscillatoria splendida* Grev., Flora Edinensis:305 (1824); Gom., Monogr. 2:244, pl. VII, fig. 7—8 (1893).

Articles plus longs que larges, 2—3  $\mu$  de diam., 3—8  $\mu$  de longueur, au protoplasma contenant quelques granules au voisinage des cloisons. Trichomes non rétrécis au niveau des articulations, flexueux et longuement atténués vers le sommet; cellule apicale renflée en tête presque ronde, sans coiffe.

CS: à l'embouchure du Yarkon, III.

26. *Oscillatoria tenuis* Ag., Alg. Dec., 2:25 (1813); Gom., Monogr. 2:240, pl. VII, fig. 2—3 (1893).

Articles carrés ou moins longs que larges, 4—8  $\mu$  de diam., 3—5  $\mu$  de long.; trichomes très peu rétrécis au niveau des cloisons, non atténués vers le sommet ni capités, à cellule apicale convexe; cloisons bordées de deux lignes de granules.

J: Anatoth, dans une petite flaque d'eau en voie de dessèchement, II.

27. *Oscillatoria terebriformis* (Ag.) Gom., Monogr. 2:254, pl. VII, fig. 24 (1893).

Articles carrés ou moins longs que larges, 4—5  $\mu$  de diam., 3—5  $\mu$  de long.; trichomes non rétrécis au niveau des articulations, lâchement spirales vers leur extrémité. L'article terminal est arrondi, non capité et dépourvu de coiffe.

AP: petit étang dans la baie de Haifa, IX; UJ: Ain-Hamma, source thermale, VI. Les échantillons de ce dernier endroit ont été récoltés par B. Elazari-Volcani et ont été déterminés par Fr. Drouet.

Cette espèce est indiquée dans les eaux thermales et sulfureuses. Le fait que nous l'avons trouvée dans un étang dont les eaux ne sont ni thermales ni sulfureuses n'est toutefois pas isolé. Drouet (1937, p. 607) indique au Brésil l'*Oscillatoria terebriformis* "from non-thermal waters: in seepage water from dunes",

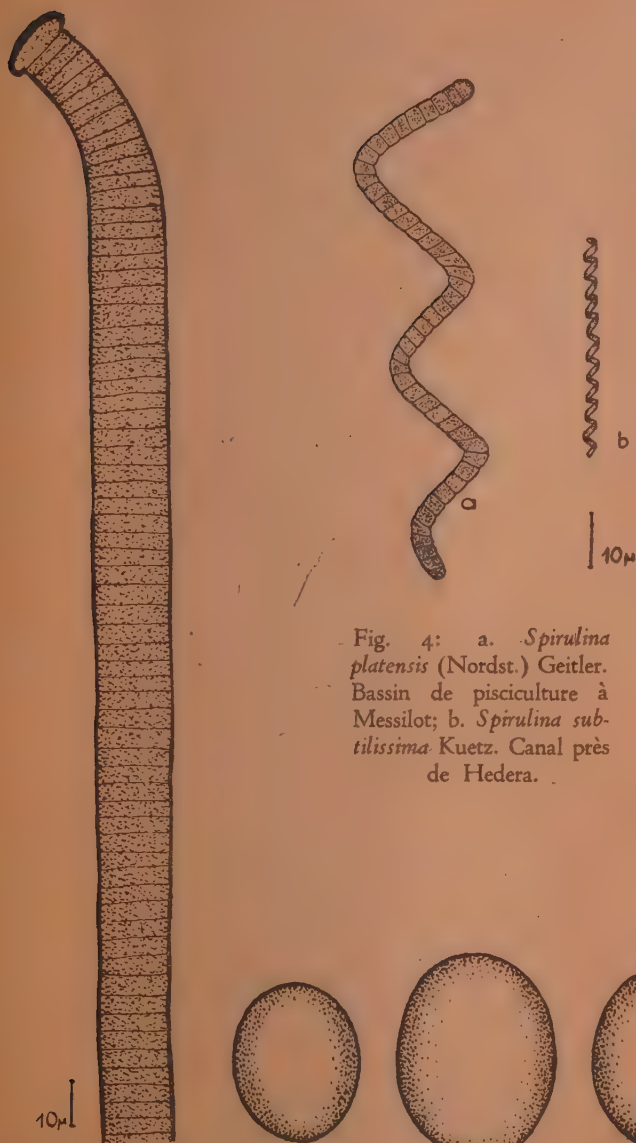


Fig. 4: a. *Spirulina platensis* (Nordst.) Geitler. Bassin de pisciculture à Messilot; b. *Spirulina subtilissima* Kuetz. Canal près de Hedera.

Fig. 3: *Oscillatoria proboscidea* Gom. Embouchure du Yarkon (Dessiné par P. Frémy).



Fig. 5: *Nostoc pruniforme* Ag. Ghivat Hammoreh. Grandeur naturelle.

28. *Spirulina platensis* (Nordst.) Geitler, Cyanophyceae, 344 (1925) = *Arthrospira platensis* Gom., Monogr. 2:267, pl. VII, fig. 27 (1893). Fig. 4 a.

Cloisons transversales bien visibles (sect. *Arthrospira*) Trichomes 5—8  $\mu$  de diam., légèrement rétrécis au niveau des articulations, non capités, enroulés en spires lâches ayant 34—51  $\mu$  de diam.; tours de spires distants de 53—57  $\mu$ . Le diamètre de la spirale n'est pas toujours constant: tantôt il diminue graduellement vers les deux extrémités comme dans les exemplaires de Fl. Rich (1931), tantôt la spirale devient complètement irrégulière.

UG: Messiloth, bassin de pisciculture aux eaux légèrement salées; produit en juillet une floraison d'eau abondante; EP: Tel-Amal, bassin de pisciculture, produisant une floraison d'eau à l'exception de presque tout autre organisme planctonique, VIII. Fréquent dans le plancton de presque tout les étangs artificiels dans la plaine de Jourdain et cause des ennuis aux pisciculteurs.

- \*29. *Spirulina labyrinthiformis* (Menegh.) Gom., Monogr., 2:275 (1893).

Trichomes de 1  $\mu$  de diam., enroulés en spirales serrées très régulières, épaisses de 2—2,5  $\mu$ , à tours presque contigus.

LJ: Kallirhoe, ruisseau d'écoulement d'une source chaude ( $T^{\circ}=35^{\circ}$ ), très peu abondant, III; Zerka—Main, source thermique ( $T^{\circ}$  de l'eau =  $52^{\circ}$ ,  $T^{\circ}$  de l'air =  $15,5^{\circ}$ ), herbier A. Aaronson: très abondant, formant presque exclusivement la masse bleu-noirâtre des algues; J: Jérusalem, aquarium marin du Dr. Haas au Laboratoire de Zoologie de l'Université Hébraïque, produisant un revêtement noirâtre sur les parois du récipient. Espèce indiquée pour les eaux thermales et les eaux saumâtres.

30. *Spirulina major* Kütz., Phyc. gen.:183. (1843); Gom., Monogr. 2:271, pl. VII, fig. 29 (1893).

Trichomes de 1—1,5  $\mu$  de diam., enroulés en spirale régulière et lâche; tours de spires: 3—4  $\mu$ ; distants entr'eux de 4—5  $\mu$ .

CS: embouchure du Yarkon, III; EP: Tel-Amal, bassin de pisciculture, III.

31. *Spirulina subsalsa* Oerst., Beretrn. Exc. til Trindelen etc., Nat. Tidskr.:17, Pl. VII, fig. 4 (1842); Gom., Monogr. 2:273, Pl. VII, fig. 32 (1893).

f. *genuina* Gom.,

Trichomes: 1,5—2  $\mu$  de diam., enroulés en spirales subirrégulières, à tours presque contigus, 4—5  $\mu$  de diam.

CS: mare à eau saumâtre à Bath-Yam, X.

32. *Spirulina subtilissima* Kütz., Phyc. gen 183 (1843); Gom., Monogr. 2:272, Pl. VII, fig. 30 (1893). Fig. 4 b.

Trichomes minces, moins de 1  $\mu$  de diam., formant une spirale régulière ayant 2,5—3  $\mu$  de diam.; distance entre les spires: 1,5—2  $\mu$ .

S: Environs de Hedera, dans un canal creusé pour l'assèchement



de Birket-Ata, III; UJ: Ain-Hamma, source thermale, VI. Les exemplaires de ce dernier endroit ont été récoltés par B. Elazari-Volcani et déterminés par Fr. Drouet.

- \*33. *Phormidium fragile* Gom., Monogr., 2:183, Pl. IV, fig. 13—15 (1893).

Diam. des trichomes: env.  $2\ \mu$ ; articles subcarrés. Filaments isolés, non réunis en plaques.

LJ: Kallirrhoe, petit cours d'eau, III.

- \*34. *Phormidium laminosum* (Ag.) Gom., Journ. Bot., 4:355 (1890); Monogr., 2:187, Pl. IV, fig. 21—22 (1893).

Diam. des trichomes:  $1,5\ \mu$ ; leur sommet est très légèrement atténué et les cloisons sont accompagnées de quatre granules réfringents.

LJ: forme des masses muqueuses au bord d'un petit ruisseau thermal à Kallirrhoe, III; UJ: Ain-Hamma, source thermale, VI. Les exemplaires de ce dernier endroit ont été récoltés par B. Elazari-Volcani et déterminés par Fr. Drouet.

- \*35. *Phormidium lucidum* Kütz., Phyc. gen.:194 (1843); Gom., Monogr. 2:199, Pl. V, fig. 11—12 (1893).

Filaments isolés à trichomes souvent engainés, épais de  $7\ \mu$ , à articles très courts, légèrement atténués-capités au sommet. Cette espèce a été figurée par nous (Frémey et R a y s s, 1938, fig. 2).

LJ: Kallirrhoe, entre les masses muqueuses bordant un cours d'eau, ne formant pas de plaques, III.

36. *Phormidium Retzii* Gom., Journ. de Bot., VI:355 (1890); Monogr. 2:195, Pl. V, fig. 6—9 (1893).

Diam. des trichomes:  $5-6\ \mu$ . Filaments un peu toruleux, aux articles plus longs que larges; gaines ordinairement absentes. Nos échantillons ont été déterminés par P. Frémy.

CS: Yarkon, près de l'embouchure, III. Assez abondant.

- \*37. *Phormidium tenue* Gom., Monogr. 2:189, Pl. IV, fig. 23—25 (1893).

Trichomes:  $1,5-1,8\ \mu$  de diam., droits, quelquefois engainés, pas ou peu rétrécis aux articulations, non atténués au sommet.

LJ: Kallirrhoe, ruisseau près de l'embarcadère, III.

- \*38. *Phormidium valderianum* (Delp.) Gom., Monogr. 2:187, Pl. IV, fig. 20 (1893).

Trichomes souvent engainés,  $2\ \mu$  de diam., articles plus longs que larges, non rétrécis aux articulations, cloisons bordées de 2 à 4 granules.

LJ: Kallirrhoe, dans des sources thermales et entre les touffes calcaires au bord de ces sources, formant des plaques épaisses, élastiques, érugineuses à l'extérieur, décolorées à l'intérieur, III.

39. *Lyngbia aestuarii* Liebm., Bemerkn. og Tillæg til danske Algfl., Krøyers Tidsskr. 492 (1841); Gom., Monogr. 2:147, Pl. III, fig. 1—2 (1893).

Trichomes: 10—14  $\mu$  de diam., dans des gaines lamelleuses, colorées en jaune-brunâtre plus ou moins foncé; articles 3 à 6 fois plus larges que longs.

AP: Um-Sherfe (près Ras-el-Nakura), X, sur les pierres de la zone littorale, mélangé, au *Microcoleus chthonoplastes*.

40. *Lyngbia Martensiana* Menegh., Consp. Alg. eugan.:12 (1837); Gom., Monogr. 2:165, Pl. III, fig. 3 (1893).

Trichomes 8—10  $\mu$  de diam., allongés, aux gaines hyalines, non rétrécis au niveau des cloisons, non atténués au sommet; articles 4 fois moins longs que larges.

LJ: Mare de Ain-Feshkha, I, récolté par E. Zwirn. Cette mare contient une certaine quantité de NaCl et reçoit des sources sulfureuses.

41. *Microcoleus chthonoplastes* Thur., Ann. Sc. Nat. Bot., sér. 6, t. I:378 (1875); Gom., Monogr. 1:91, Pl. XIV, fig. 5—8 (1893).

Trichomes 3—5  $\mu$  de diam., nombreux dans la même gaine, rétrécis au niveau des articulations; articles 1—2 fois plus longs que larges.

AP: Um-Sherfe (près de Ras-el-Nakura), X; Hachsib, X. Forme des masses compactes sur les rochers et les pierres de la zone littorale.

42. *Microcoleus paludosus* Gom., Monogr., 1:96, Pl. XIV, fig. 13 (1893).

Trichomes: 5—7  $\mu$  de diam., non rétrécis au niveau des articulations, aux articles 1—2 fois plus longs que larges; cellule terminale non capitée.

LJ: Jéricho, au fond d'un canal, en compagnie de *Vaucheria*, III.

43. *Pseudanabaena catenata* Lauterb., apud Geitler, Cyanophyceae:348 (1925).

Cellules cylindriques, 2,5—3  $\times$  1,5—2  $\mu$ , tronquées aux extrémités, au centroplasma nettement visible.

CS: Bath-Yam, mare à eau saumâtre, X.

44. *Schizothrix calcicola* (Ag.) Gom., Monogr. 1:45, Pl. VIII, fig. 1—3 (1893).

Gainnes renfermant 1, 2, 3 et jusqu'à 5 trichomes, non rétrécis à l'endroit des cloisons; diam. des trichomes: 1—2  $\mu$ . Forme des masses consistantes, crustacées, mamelonnées, presque charnues, de couleur vert-olive-noirâtre. Les gainnes ne bleuissent pas sous l'action du chloroiodure de zinc.

CS: Rehovot, jardin du Dr. H. Oppenheimer, sous un tuyau d'une fontaine qui laisse tomber l'eau goutte à goutte. Cette algue y forme des espèces de stalactites, en compagnie des bactéries ferrugineuses, VIII (Oppenheimer, 1941).

45. *Symploca elegans* Kütz., Phyc. gen.:201 (1843); Gom., Monogr. 2:136 (1893).

Thalle formant des mèches droites, anastomosées; gaines assez épaisses, ne bleuissant pas sous l'action de chloroiodure de zinc; trichomes 1,5—2  $\mu$  de diamètre, articles longs de 2—4  $\mu$ .

S: environs de Birket-Ata, terre humide, III.

*B. Anhomocystee*

Fam. *Nostocaceae*

46. *Nostoc commune* Vauch., Hist. des Conf.:222 (1803); = *Stratonostoc commune* (Vauch.) Elenk.

Thalle d'abord globuleux, ensuite étalé, plissé, difforme, atteignant la dimension de 1—3 centimètres, érugineux, olivâtre ou jaune-brunâtre; gaines visibles seulement dans la région périphérique du thalle; trichomes 5—5,5  $\mu$  de diam., formés par des articles sphériques, comprimés; hétérocystes presque sphériques, 7  $\mu$  de diam.

J: Jérusalem, Motsa, Kiryath-Anavim; JD: désert de Jéhuda; CA: Haifa—Carmel; LG: Gineigar. Sur la terre humide, le long des chemins, dans les bois, sur le sol aride désertique, sur des rochers plats, très fréquent pendant la saison des pluies, se desséchant ensuite jusqu'à former des pellicules minces noirâtres qui se gonflent aussitôt remises dans l'eau.

47. *Nostoc verrucosum* Vauch., Hist. des Conf.:225, Pl. XVI, fig. 3 (1803); = *Stratonostoc verrucosum* (Vauch.) Elenk. emnd.: (1) f. *typicum* Elenk. (2) f. *parmelioides* (Kütz.) Elenk. (= *Nostoc parmelioides* Kütz.)

Thalles globuleux puis creux, prenant dans la forme *parmelioides* l'apparence d'un disque, à surface mamelonnée, 5—7 cm. de diam.; trichomes densément enchevêtrés, 3—6  $\mu$  de diam., aux articles subsphériques, rétrécis un peu davantage à l'endroit des articulations dans la forme *parmelioides*; spores durables rares, 7—7,5  $\times$  4—5  $\mu$ ; hétérocystes: 6—7  $\mu$  de diam. Les deux formes de Elenkin, f. *typicum* et f. *parmelioides*, ont été considérées comme deux espèces distinctes avant Elenkin; nous trouvons dans notre station plusieurs états intermédiaires, se rapprochant tantôt d'une forme, tantôt de l'autre.

UG: Tel-el-Kadi, sur les pierres de la cascade aux eaux froides et au cours rapide, III, V.

48. *Nostoc punctiforme* (Kütz.) Hariot, Journ. Bot., 5:31 (1891) = *Amorphonostoc punctiforme* (Kütz.) Elenk.

Thalle subglobuleux, microscopique, 40—50  $\mu$  de diam., ressemblant à un *Microcystis* à cause de ses filaments très serrés; diam. du trichome: 3—4  $\mu$ ; hétérocystes: 4—5  $\mu$ , subsphériques.

G: Yarmouk, VIII.

49. *Nostoc pruniforme* Ag. Disp. Alg. Suec.:45 (1812); = *Sphaeronostoc pruniforme* (Ag.) Elenk. Fig. 5.

Thalle globuleux, mou en dedans et devenant quelquefois creux,



1—3 cm. de diam., à périderme coriace, lisse; trichomes épais de 4—5  $\mu$ ; hétérocystes presque globuleux, 6—7  $\mu$  de diam.

LG: Ghivat Hammoreh, dans de petites plaques d'eau remplissant les creux dans des rochers, III—IV. Leg D. Rijik.

- \*50. *CylindrospERMUM stagnale* (Kütz.) Born. et Flah., Révision, 4:250 (1888).

Diam. des trichomes: 3—4  $\mu$ ; spores cylindriques, à épisore brune, 35—40  $\times$  12—16  $\mu$ ; diffère du type par les articles des trichomes qui sont subcarrés. Nous avons donné ailleurs la figure de cette espèce (Frém y et Rayss, 1938, fig. 4).

LJ: Kallirrhoe, petite source thermale, T°=40°, assez abondant, III. Espèce cosmopolite dans les eaux douces; a été signalée dans les eaux thermales seulement à Yellowstone (Amérique du Nord) par Copeland.

51. *Anabaena spiroides* Klebahn, Flora, 80:268, Pl. IV, fig. 11—13 (1895).

Diam. des trichomes: 7—8  $\mu$ ; hétérocystes sphériques, 6, 5—7  $\mu$  de diam.; spores durables: 10—13,5  $\mu$  de diam., plus ou moins sphériques ou elliptiques; spires larges de 43—52  $\mu$ ; gelée muqueuse, difficilement visible. Espèce très polymorphe.

UJ: Kinnereth, bassin de pisciculture, formant au mois de mars la fleur d'eau, ensemble avec *Oscillatoria Mougeotii*; Messiloth, bassin de pisciculture, mélangé au *Spirulina platensis*, en moindre quantité. Les tours de la spirale dans les exemplaires de Kinnereth sont plus nombreux.

Fam. *Scytonemataceae*

52. *Hassalia byssoidea* Hass., Brit. Freshw. Alg. 1:233, Pl. 67, fig. 5 (1845) = *Tolypothrix byssoidea* Kirchn.)

Filaments fragiles, 13—18  $\mu$  de diam., irrégulièrement rameux; gaines étroites, jaune-brunâtre; diam. des trichomes: 9—12  $\mu$ ; hétérocystes à la base des filaments, solitaires, rarement par deux, 8—10  $\mu$  de diam.

J: Silouan, rochers suintants, I.

- \*53. *Scytonema velutinum* (Kütz.) Rabenh., Deutsch. Krypt. Fl. 1:86 (1847).

Diam. des trichomes: 10  $\mu$  en moyenne; gaines jaunes, à lamelles souvent disposées en entonnoir; ramification simple ou gémée. Notre figure de cette espèce a paru précédemment (Frém y et Rayss, fig. 5).

LJ: Kallirrhoe, entre les masses d'algues le long et dans les sources thermales, III.

Fam. *Nodulariaceae* Elenk. (= *Microchaetaceae* Lemmerm. p. p.)

54. *Aulosira thermalis* G. S. West apud Geitler, Cyanophyceae: 285 (1925).

Diam. des filaments: 5—6  $\mu$ , diam. des trichomes: 3  $\mu$  en

moyenne; spores durables:  $6,5-9 \times 4,5-5,5 \mu$ . Rappelle un peu l'*Aulosira africana* Frémy mais en diffère par ses spores durables de dimensions beaucoup plus petites et non rétrécies en leur milieu.

LJ: Kallirrhoe, source thermale ( $T^{\circ}=35^{\circ}$ ) IV. Cette espèce a été indiquée dans les eaux thermales en Islande.

Fam. *Rivulariaceae*

55. *Calothrix aeruginea* Thur., Ann. Sc. nat. Bot. 6 sér. 1:381 (1875); Born. et Flah., Révision, 1:358 (1886).

Filaments longs de 0,5 mm., épais de  $9-11 \mu$ , un peu épaissis à la base; gaines incolores, assez épaisses; diam. des trichomes:  $5-9 \mu$  à leur base; ils se terminent par un long poil.

S: Caesarea, sur les filaments de *Chondria*, VIII.

56. *Calothrix parietina* Thur., Ann. Sc. Nat. Bot., sér. 6, 1:381 (1875); Born. et Flah., Révision, 1:366 (1886).

Filaments isolés ou réunis en thalle crustacé, jaune-brunâtre, aux gaines brunâtres assez épaisses, opaques, lamelleuses; trichomes olivâtres,  $5-10 \mu$  de diamètre, se terminant par un long poil; hétérocystes basilaires.

J: sur les parois d'un bassin d'eau dans le Jardin Botanique de l'Université, Jérusalem, VII.

57. *Calothrix parasitica* (Chauv.) Thur., Ann. Sc. Nat. Bot., 6 sér., 1:381 (1875).

Filaments longs de  $100-120 \mu$ , bulbeux à leur base; épaisseur du bulbe:  $10-15 \mu$ ; trichomes à articles courts, atténués en un long poil; hétérocystes basilaires, solitaires.

S: Athlit, V, sur le *Nemalion helminthoides* (Vellig). Batters.

58. *Calothrix pulvinata* Ag., Syst. Alg.:71 (1824); Born. et Flah., Révision, 1:356 (1886).

Filaments flexueux, 2-3 mm., aux gaines épaisses en forme d'entonnoir; diamètre des trichomes:  $9-11 \mu$ .

S: Athlit, sur les rochers, au dessous du niveau de la mer, XII;  
AP: Tel-Samakh près de Haifa, XII.

59. *Calothrix scopulorum* (Web. et Mohr) Ag., Syst. Alg.: 70 (1824); Born. et Flah., Révision, 1:353 (1886).

Filaments simples, peu ramifiés, tortueux, formant un gazon de 0,3-1 mm. de hauteur; trichomes  $7-9 \mu$  de diam., prolongés en un long poil; hétérocystes basilaires, très rarement on trouve un hétérocyste intercalaire. Quelques filaments mêlés aux filaments typiques ont l'apparence d'un *Lyngbia*.

S: Caesarea, sur les pierres et les rochers émergés, formant des couches étendues entre les enduits glissants des autres Cyanophycées, VIII.

Fam. *Stigonemataceae*

- \*60. *Hapalosiphon laminosus* (Kütz.) Hansg., Bot. Ctrbl., 22:481 (1885); Born. et Flah., Révision, VII, 5:55 (1887), f. *microchaetoides* Frémy.

Trichomes ayant 2,5—3  $\mu$  de diamètre, inclus dans des gaines minces parfois jaunâtres; hétérocystes très rares; spores nombreuses, disposées en séries discontinues le long du trichome, 8—10  $\times$  4—5  $\mu$ , parfois brunâtres ou jaunâtres.

LJ: Kallirrhoe, entre les masses d'algues bordant une source thermale, III. La figure que nous avons donnée dans notre publication précédente (Frémy et Rayss, 1938, fig. 3) se rapporte à la forme *microchaetoides* Frémy et pas à l'*Hapalosiphon laminosus* Hansg. typique, comme il a été indiqué par erreur.

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# SOME INTERESTING USTILAGINALES NEW TO PALESTINE

By T. RAYSS and E. ZWIRN

## 1. *Entyloma Catananches* Ciferri

On leaves of *Catananche lutea* L., Jerusalem, 18.iv.1942. Leg. H. Habelska.

Chlamydospores: 12—16  $\mu$  diam.

The species was separated by Ciferri from the collective species *E. Calendulae* (Oudemans) De Bary. It has been reported from S. Europe and N. Africa on *Catananche caerulea* L., and *C. lutea* is probably a new host.

## 2. *Entyloma Dahliae* Syd.

On leaves of *Dahlia variabilis* Desf., Ramath-Gan, 12.xii.1944. Leg. A. Steiner.

Chlamydospores: 12—16  $\mu$  diam; epispore: 1.5—2.5  $\mu$ .

The destructive disease caused by this smut was first reported from South Africa in 1911 and introduced to Europe (France, Switzerland) in 1922. With the export of plants it spread quickly to other countries: Germany (1924), Poland (1925); Czechoslovakia (1926), England (1928), Austria (1934), Rumania (1936, probably present since 1932), Sweden (1938). It has since spread to Asia (India, Ceylon, Sumatra), N. America, Argentina, Venezuela, Brazil, Guatemala and New Zealand. This is the first indication of the fungus in Palestine, and, as far as we are aware it is also the first time it is mentioned from the Mediterranean Region and the Near East.

## 3. *Entyloma Eryngii-tricuspidati* R. Maire

On leaves of *Eryngium creticum* Lam., Jerusalem, 24.iv.1942.

Sori flat, 2—3 mm in diameter, brown, rapidly drying; spores: 9—13  $\mu$ , with smooth epispore, 2—2.5  $\mu$  thick.

This species was described by R. Maire in N. Africa on *Eryngium tricuspidatum*; our plant is therefore a new host. The sori in our specimen are slightly larger than Maire's diagnosis indicates (0.5—2 mm), and it would therefore seem to correspond more closely to *Entyloma Eryngii-plani* Ciferri. However, Ciferri himself considers his species to be not appreciably different from *E. Eryngii-tricuspidati* Maire. Moreover, our host is more nearly related to *Eryngium tricuspidatum* than to *E. planum*.

## 4. *Entyloma Meliloti* McAlp.

On leaves of *Melilotus sulcatus* Desf., Magdiel, 10.v.1943. Leg. H. Habelska.

Chlamydospores: 12—14  $\mu$  diam.

The fungus was described on *Melilotus indica* All. (= *M. parviflora* Des.) in Victoria (Australia); on the same host it was found in Louisiana. *Melilotus sulcatus* is probably a new host.

### 5. *Entyloma serotinum* Schröter

On leaves of *Symphytum palaestinum* Boiss., Beth-Hakerem, 30.iii.1939.

Chlamydospores: 11—14  $\mu$ ; sori: 2—3 mm, smaller than is indicated by the diagnosis (2—4 mm).

The fungus is known on *Symphytum officinale* and *S. tuberosum*; *S. palaestinum* is therefore a new host.

### 6. *Tuburcinia Ranunculi* (Libert) Liro

On leaves of *Ranunculus asiaticus* L., Alonim, 14.iii.1940. Leg. T. Kushnir.

Fertile spores sometimes lacking an envelope of sterile cells, 10—14  $\times$  12—16  $\mu$ ; sterile cells: 7—10  $\times$  12—14  $\mu$ .

This fungus has been indicated on the same host by Pampinini in Tripolitania (sub *Urocystis anemones*). Although *Ranunculus asiaticus* is a plant of wide occurrence in Palestine, we did not find the fungus more than once.

### 7. *Tuburcinia tritici* (Kcke.) Liro (= *Urocystis tritici* Kcke.)

On leaves of *Triticum durum* Desf.: Kiryat-Anavim, 6.v.1938; Deir-esh-Sheikh, 12.iii.1941.

Spore balls: 15—36  $\mu$  (typically 24—30  $\mu$ ). Fertile spores: 12—15  $\mu$  diam. where a single fertile spore is enclosed by sterile cells, 15—21  $\times$  9—15  $\mu$  where there are 2, 3 or 4 fertile cells in the centre. Sterile cells 7—12  $\mu$  long, yellowish brown in colour. The disease appears in the form of parallel, lead-grey stripes on the leaves, at first covered, later rupturing the epidermis and setting free a black mass of spores. Strong deformations of the culms are frequent.

The first samples from the vicinity of Kiryat-Anavim were collected in an Arab field; only a small number of the plants was infected. Since then we have found the disease year after year in the same field on a few of the plants, while we did not succeed to detect it in other localities. In 1941 we found another Arab field between Deir-esh-Sheikh and Hartouv (in the Judean mountains) heavily infected by flag-smut; thereafter, however, we have no data as to the spread of the disease. To our knowledge, this is the first indication of the fungus in a Palestinian field. Minz (1943) records that he found *Tuburcinia tritici* in Palestine on wheat straw imported from U.S.A. as a packing for glassware. — Flag smut is known to occur in Japan, China, India, Australia, U.S.A., S. Africa, Germany, Holland, S. Russia, Bulgaria, Italy, Spain, Caucasus, Turkestan, Cyprus and Egypt. A communication from Dr. Bremer (in litteris) also informs us of its occurrence in Turkey. It is one of the most destructive diseases of wheat in most of these countries, and its appearance in Palestine should therefore be regarded with strong apprehension.

# 8. *Ustilago Scorzonerae* (Albertini et Schweinitz) Schroeter

In floral heads of *Scorzonera papposa* DC.: Gilboa, 25.iii.1944. Leg. D. Rizik.

Chlamydospores:  $8-14 \times 10-15 \mu$ ; epispore:  $1-2 \mu$ ; areoli:  $1-2.5 \mu$ .

The fungus is known in Europe on *Scorzonera humilis* L., *S. aristata* Ram., *S. austriaca* Willd., *S. hispanica* L., *S. purpurea* L., *S. rosea* W. K. *Scorzonera papposa* is thus a new host.

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- Later indications as to distribution were taken from the *Review of Applied Myrology*.

## A NEW RHEUM SPECIES FROM PALESTINE

By NAOMI FEINBRUN

(With Plate III)

*Rheum palaestinum* Feinbr. sp. nov.

Sect. *Acaulia* A. Lōs.

Syn. *Rheum Ribes* auct. fl. pal.

Affinis *Rh. nano* Siewers sed ab eo differt: foliorum indumento; perigonio minore; pedicellis tenuibus (nec crassis) supra medium (nec ad basin) articulatis; alae fructus nervo fere marginali (nec ab margine 1—1½ mm. distante); area geographica.

Perennis; rhizoma verticalis, crassa, fusca, transverse grosse rugosa; caulis scapiformis aphyllus, 20—25 cm. altus, 5—10 mm. crassus, glaber, longitudine sulcatus, inflorescentiam ramosam paniculatam, ovatam vel late-triangulari ferens; folia reniformia vel fere rotunda, 20 cm. lata (saepe maiora, ad 40—60 cm. longa et 50—70 cm. lata), basi auriculata, 3-nervia (ad basin nervis duobus minoribus additis), coriacea et paulo succulenta, in sicco rugulosa, superne pulverulenta, inferne nervis valde prominentibus longitudine minute papillosa, margine repanda et minute papilloso-ciliata; petiolus brevis, vagina petiolo longior, ad margine scariosa, ferruginea; pedicelli floriferi tenues, supra medium articulati, perigonio + aequilongi; perigonii lobi ca 2 mm. longi, ovato-oblongi; pedicelli fructiferi recurvi; fructus (immaturus) 10—12 mm. longus, eius alae 2—2½ mm. latae, nervus ab margine ca. ¼ mm. distans.

Habitat in steppis Transjordaniae et Cisjordaniae australis.

Specimens seen<sup>1</sup>: Transjordan: 25 km. SW. of Ma'an, 1000 m. (March 1937 No. 13746 *Dinsmore*; flowers; type!); Qatrani (Apr. 1936 No. 11746 *Dinsmore*; fruit; type!); Transjordan (1929 *Naftolsky*; immature fruit); 8 km. of Ma'an (Apr. 1929 *EZ*); el Hasa to 'Aneze (Apr. 1929 *EZ*); Ziza to Qatrani (Apr. 1929 *EZ*); 10 kms. S of Khan Zebib, 880 mm. (March 1936 *EFZ*); Ghor el Mezrah to Karak (March 1924 *Breslavsky*); near Karak (Apr. 1933 *Dinsmore*); el Kharani. (May 1927 *EFZ*). F a r N e g e b: Sahel el Hewa, *Artemisietum Herbae albae*, on calcareous soil (1945 *D. Zohary*); Wadi Raman plateau, Wadi el A'jram, *Artemisietum Herbae albae*, on calcareous soil (1945 *D. Zohary*).

This plant has been reported from 'Palestine'<sup>2</sup> under *Rh. Ribes*

<sup>1</sup> Abbreviations: *E*=*A. Eig.*, *F*=*N. Feinbrun*, *Z*=*M. Zohary*.

<sup>2</sup> Solely from Transjordan. It was only recently that the plant was found also in the Far Negeb.



by Boissier, Post (1896), Post-Dinsmore (1933) and Eig (1932). — Boissier recorded only two species of *Rheum* in his *Flora Orientalis*, *Rh. Ribes* and *Rh. tataricum*. The number of *Rheum* species of the region has since been greatly increased by studies of Russian botanists. The *Flora URSS* (1936) gives 22 species, chiefly from Russian Middle Asia. Losina-Losinskaja, who revised the genus *Rheum* for the above *Flora*, divides the genus into 7 sections. Our species seems to fit into the Sect. *Acaulia* Los.

The most prominent characteristics of *Rh. palaestinum* are: flowering stem destitute of leaves, glabrous, grooved; radical leaves coriaceous, 3-nerved and papillose beneath along nerves.

*Rh. Ribes*, with which our plant was confused, belongs to the Sect. *Ribesiformia* Los. and differs from *Rh. palaestinum* by its sharply muricate stem and leaves, by number of leaf-nerves (5), long petioles, long-pedicelled flowers, etc. It belongs to the alpine and subalpine mountain regions. I examined two specimens from the Lebanon.

*Rh. palaestinum* is an Irano-Turanian plant, confined to several steppe associations of the plateaux (800—1000 m.) of Transjordan and of the Far Negeb. Its large leaves, spread on the ground, are very conspicuous.

An interesting feature of this plant is its rather irregular flowering. It flowers in March and fructificates in April. Although numerous specimens were found in different localities of Transjordan at the end of March (1936), in April (1929) and at the beginning of May, we saw scarcely one in flower or fruit. One flowering and one fruiting specimen were kindly made available to me by Mr. J. E. Dinsmore, and one somewhat incomplete fruiting specimen by Mr. N. Naf-tolsky, to both of whom I wish to convey my deep thanks.



A



B



C

*Rheum palaestinum* Feinbr. sp. nov.

- A : 1—Upper part of root stock, 2—leaf seen from beneath, 3—inflorescence, 4—fruiting inflorescence  
 B : Fruit  
 C : *Rheum palaestinum* in its natural habit in Edom. The late Prof. A. Eig on his expedition to Trans-Jordan in 1936, (photo M. Evenari)





1. *Scrophularia Guestii* sp. nov. 2. *S. kurdica* sp. nov. 3. *S. clematidifolia* sp. nov. 4. *S. Nabataeorum* sp. nov. 5. *S. telavivensis* sp. nov.







גם *Entyloma dahliac* הוא טפיל מסוכן ועלול לגרום להפסדים ניכרים במשתלות שבהן מגדלים את הדליה. המחלה מתגלה בכתמים שחורים על העלים. עד כמה שידוע לנו לא נמצאה פטריה זו עד כה בארץ ולא נודעה גם באיזור היס-תיכוני בכלל ובמזרח הקרוב. מלבד מינים אלה מובאים בעבודה זו עוד ששה מינים אחרים, שמצאנום בארץ על פונדקאים חדשים.

### *Rheum palaestinum* Feinbr. sp. nov.

מאת נ. פינברון

מין חדש זה של חסוג *Rheum* הובא עד עתה בספרות (בואסיה, פוסט, איג) מעבר הירדן המזרחי בשם *Rheum Ribes*. אולם המין האחרון שונה בסמנים רבים מהמין שלנו: הגבעולים והעלים בעלי הגבשושים חחדים, מספר העורקים הראשיים של העל הוא 5 ועוד. המין החדש (טבלא III) שייך לסקציה *Acaulia*. הוא מין אירנו-טורני, הקשור לחברות ערביות שונות של רמות גבוהות אשר בעבר הירדן. בזמן האחרון נמצא גם ברמות הגבוהות של הגלב הרחוק (ע"י דניאל זהרי). תכונה מצוינת של הצמח היא פריחתו הבלתי קבועה. זמן פריחתו הוא חדש מרס וזמן הבשלת פירותיו – אפריל. אם כי צמחים רבים נאספו ע"י המחבר וחבריו בחדשים הנ"ל, לא נמצאו כמעט צמחים בפריחה או פרי. לשם תאור המין החדש שמשו פירות ופרחים שנתקבלו ממר י. דינסמור (המושבה האמריקאית ירושלים) וממר נ. נפתולסקי ובוזה נתונה להם גם תודתי על כך.

## אצות כחוליות מארץ-ישראל

מחקר על אצות ארץ-ישראל חלק א'

מאת ט. רייס

בעוד שהצמחים העילאיים של ארצנו נחקרו זה מכבר מנקודות מבט רבות ומשמשים גם עכשו נושא למחקרים יסודיים מקיפים, ידיעתנו על הצמחים הנחותים של ארץ-ישראל נמצאת עדיין בשלביה הראשונים. הקריפטוגמים הידועים ביותר לפי שעה הן הפטריות. עיבודן של הללו נעשה מבחינה סיסטמטית, פיטופתולוגית ופיטוגיאוגרפית. גם את החזויות התחילו רק בשנים האחרונות לעבד, ועד עתה הופיעו 5 עבודות של ד"ר רייכרט העוסקות באופן ישר או בלתי ישר בצמחים אלה. על טחבים פורסמה עד כה עבודה אחת בלבד של גב' ד"ר סירני. קבוצה זו מחכה איפוא לעבוד יסודי. אשר לאצות, הופיע בזמן האחרון רק מספר קטן של עבודות. אבל אף אחת מהן אינה נותנת מושג כללי על צמחית האצות של ארץ-ישראל.

במשך עשר השנים האחרונות עסקנו במחקר האצות וברצוננו להתחיל כעת בפרסום תוצאות העבודה הזאת באופן שטתי. בפרסום הנוכחי מופיעים 60 מינים של אצות כחוליות. האצות האלה נאספו בכל חלקי הארץ. על פני האדמה, בברכות ובשלוליות הנוצרות בתקופת הגשמים, בברכות-דיג מלאכותיות, במעיינות, בפלנקטון של ים הכנרת וים החולה, כמו גם בחופו של הים התיכון. שמות האצות, תאורן ובתי גדולן נתנים בגוף העבודה.

## מספר פטריות-שדפון חדשות לארץ-ישראל

מאת ט. רייס וא. צוירן

בעבודה זו אנו מודיעים על המצאם בארץ של שמונה מיני פטריות הנמנים על קבוצת פטריות-השדפון. מינים אלה לא היו ידועים בארצנו עד כה. שנים מהם הנם בעלי חשיבות כלכלית מיוחדת, היינו *Tubercinia tritici* ו-*Entyloma dahliae*.

*Tubercinia tritici* גורמת למחלה המסוכנת של חטה בארצות רבות: ביפן, סין, הודו, אוסטרליה, ארצות הברית, אירופה הדרומית, קבקו, טורקסטן, קפריסין ומצרים. היא גורמת הפסדים גדולים ביבול. מינץ (השדה 1943) מצא את הפטריה הזו על הקש שהובא ארצה בתור חומר אריזה לכלי זכוכית; אך אנחנו מצאנו אותה בפעם הראשונה עוד בשנת 1938 בשדה ערבי בסביבת קרית-ענבים, ובשנת 1941 בדיר א-שיך. הופעתה של מחלה זו מעוררת חששות רציניים והיא דורשת השגחה מעולה לבל תתפשט.



# בדיקת המינים האורינוטליים של הסוג לווענית (Scrophularia) מתוך עשבית האוניברסיטה העברית

מאת א. איגי

ניתן בזה עיבוד סיסטמטי של מיני הלווענית המצויים בארץ-ישראל, סוריה, עיראק ותורכיה הדרומית, שנאספו ע"י המחבר והבריו בעבודה.

שטיפלהגן (1910 Stiefelhagen), מחבר המונוגרפיה של הסוג, מיחס לסוריה 12 מינים; הפלורה של פוסט-דינסמור (1933 Post-Dinsmore) מוסיפה לסוריה עוד 5 מינים והנדל-מצטי (1912 Handel-Mazzetti) מוסיף מצדו עוד מין אחד; וכך מצטרף מספר מיני הלווענית המובאים מסוריה ל-18.

מארץ-ישראל נזכרים ע"י שטיפלהגן 6 מינים ופוסט דינסמור מזכירים עוד 6 מינים, בס"ה 12 מינים. מעירק מזכיר שטיפלהגן 6 מינים.

לפי עבוד החמר של Scrophularia אשר בעשביתנו שונה רשימת המינים של הארצות הנ"ל מזו של שטיפלהגן; לפי עבוד זה מיוצג הסוג הזה בארץ-ישראל ע"י 9 מינים דלקמן:

*Scrophularia macrophylla*; *S. Nabataeorum* Eig sp. nov., *S. Michoniana* Cass. et Kral., *S. telavivensis* Eig sp. nov., *S. xylorrhiza* Boiss. et Hausskn., *S. xanthoglossa* Boiss., *S. Peyroni* Post, *S. deserti* Del., *S. hypericifolia* Wydl.

בסוריה מצויים 12 המינים דלקמן:

*S. peregrina* L., *S. Scopoli* Hoppe, *S. antiochia* Post, *S. clematidifolia* Eig sp. nov., *S. macrophylla* Boiss., *S. Michoniana* Cass. et Kral., *S. lucida* L. var. *filicifolia*., *S. sphaerocarpa* Boiss. et Reut., *S. xylorrhiza* Boiss. et Hausskn., *S. xanthoglossa* Boiss., *S. Peyroni* Post, *S. libanotica* Boiss.

מספר המינים המצויים בעירק הוא 10 והם:

*S. Guestii* Eig sp. nov., *S. macrophylla* Boiss., *S. xanthoglossa* Boiss., *S. deserti* Del., *S. marginata* Boiss., *S. pruinosa* Boiss. ssp. *iraquensis* Eig ssp. nov., *S. libanotica* Boiss.

המינים של תורכיה הדרומית הם:

*S. Kotschyana* Bth., *S. macrophylla* Boiss., *S. tagetifolia* Boiss. et Hausskn. ssp. *diversifolia* Eig ssp. nov., *S. libanotica* Boiss.

בעבודה זו תוארו לראשונה 5 מינים של הסוג לווענית, בת-מין אחת ו-7 וריטטים.

(ו) צומח של מלחות

מצומח זה רשמנו את החברות האלו:

(20) חברת ימלוח; (21) חברת דו־עלה לבן; (22) חברת סואדה חולענית  
— דו־עלה אדום; (23) חברת אשל המן; (24) חברת סמר ערבי. מכל החברות  
ראינו דוגמאות מספר ורובן מרוכזות בחלק המזרחי (בין סואץ וודי פירן).

(ז) צומח של סלעי גיר זקופים.

רשמנו רק את: (26) חברת הצלף המצרי (בודי טאיבה).

(ח) צומח של אזור ההרים (בין ודי שייך לג'בל מוסה הוא הר סיני)

החל מהגובה של 1000 מ' ומעלה מתחלף הצומח במדה מהירה למדי  
עם הוסיפנו לעלות ההר. בגובה של 800 מ' עדיין שולטת:

(27) חברת לענת יהודה המופיעה לראשונה בדרכנו במוצאו של ודי שייך  
מתוך ודי פירן. עפ"י קשורה חברה זאת לאפיקי ודי רבודים חול גרניטי,  
בגובה גדול יותר (כ־1000 מ') מתלווה אל הלענה צמח שולט אחר והיחידה  
המתקבלת היא:

(28) חברת לענה — צילה. בגבה גדול יותר תופסה הצלה הקוצנית את  
המקום הראשי בחברה (29) והיא שולטת עד לרגלי הר סיני. בגובה של 1630  
מ' — 1700 מ' מתחילה לשלוט (30) חברת הלענה המדברית המופיעה כאן  
בוריאנט מיוחד. הקו המאפיין את החברה הזו כאן היא נוכחותם של צמחים  
אירנו־טורניים רבים כמו למשל *Varthemia montana*, *Atrophaxis*, *Pyrethrum*  
*rum santolinoides* וכו'. בגבה גדול יותר נתון השלטון בידי שני צמחים והם:  
*Pyrethrum santolinoides* ו־*Phlomis aurea* ואליהם נלוים עשבים, שיחים  
ועצים שונים (ראה רשימת הצמחים בעמוד 77). מ־2000 מ' בערך ועד לראש ההר  
שוב מופיעים *Pyrethrum* ולענת המדבר כצמחים שולטים והללו מלוים צמחים  
רבים הנמנים בעיקר על האלמנט האירנו־טורני.

## 6. סכום

כסכום לכל המובא לעיל יש להדגיש כי אמנם היה למוד הצומח בנסיעה  
הזאת חטוף למדי וכי יחידות הצומח הנקובות לעיל הן עוד ארעיות למדי,  
ואעפ"כ הסירה נסיעה זאת במידה רבה את הלוט מעל חבל ארץ, אשר מבחינת  
הצומח לא ידענו עליו ולא כלום. כן בוררו הפעם יחסים פיטואוגרפיים ואקולו־  
גיים של צמחים אחדים בעלי ערך פיטוסוציולוגי רב, כמו למשל *Verbascum*  
*Schimperi*, *Phlomis aurea*, *Artemisia judaica*, *Artemisia Herba alba*,  
*Aristida scoparia*, *Aristida plumosa*, *Haloxylon salicornicum* *Phlomis*  
*aurea* ואחרים.

השיח כצמח של חול מוקשה פחות או יותר או של חמדה חולית. רשמנו את החברה הזאת בחתך II (a) ובחתך III (b, c, d, e, f, g, h).  
(6) חברת פרקק השיח-צלה קוצנית קשורה לגדות ודיים. כנראה צורת מעבר לחברה מספר 29. רשמנו בחתך III (i).

(ב) צומח של דיונות ומישורי חול

(7) חברת מלענן המטאטאים. נפוצה מאד בצפון סיני. היא תופסת בעיקר מורדות מוגנים של דיונות נודדות וכן גם את ראשי הדיונות כשאינן יותר בתנועה. רשמנו ברוב הקטעים של חתך I ו-II.

(8) חברת לענה חד-זרעית. היא מצויה בדיונות קשורות או נחות. אינה ביותר בדרכים בהן עברנו. רשמנו בחתך I (g) ובחתך II (e).

(9) חברת רותם המדבר. היא מצויה גם באפיקים רבודי חול וגם בחולות נחים. מלבד זה היא מופיעה גם בנחלי אכזב רבודי חלוקים וחצץ. בכלל יש לחלקה ליחידות אחדות בהתאם להרכבה ולבית גדולה. רשמנו בדרכנו בחתך I (g, i) ובחתך II ברוב הקטעים וכן גם בחתך III (d, f, h).

(10) חברת דוחן אשון. מופיעה בחלק המערבי במקום שהחמדה מכוסה בשכבה עבה של חול. היא קרובה באקולוגיה שלה לחברה מספר 4. רשמנו בחתך II (a).

(11) חברת מלענן הנוצות. מוגבלת לחלק המערבי של שטח חקירתנו ומופיעה בשקעי החול שעל פני החמדות העקרות.  
(12) חברת פגוניה. קרובה באקולוגיה שלח לחברה שנזכרה לפניה. רק פעם ראינוה בחלק המזרחי של החתך סואף-עוג'ה.

(ג) צומח של הגבעות הסדשיים בצפון סיני

מבין יחידותיו רשמנו את:

(13) חברת דו-עלה שיחני (1398 איג)

(14) חברת רומוריה שעירה.

(ד) צומח של קרקעות הלס בצפון סיני

מבין יחידותיו רשמנו את:

(15) חברת פרקק המדבר

(16) חברת פרקק המדבר - צלה קוצנית.

שתי החברות נפגשו בדרכנו בחתך מספר II (e, d, j) וכן גם בחתך I (a). שם מתקשרת חברה זאת אל שטח תפוצתה בנגב של-ארץ ישראל.

(ה) צומח של נחלי האכזב והגיאיות הגדולים

ממנו רשמנו את היחידות הבאות:

(17) חברת שרביטן המדבר

(18) חברת בוצין שימפר - אשבל סיני.

הראשונה קשורה בעיקר לאפיקים רחבים וכן גם למעלי הגיאיות. בשעה שהשניה קשורה לגדות נחלים מרובי חלוקים וחצץ.

(19) חברת שכרון קהה מצויה בעיקר באפיקים מכוסי חול ולחיס במקצת.

שמגובה של 1.000 מ' ומעלה נעשים השלגים תדירים יותר, ולא עוד אלא שלפי שימפפר רבץ השלג (בשנה מסוימת) בג'בל קטוינה ב-51 $\frac{1}{2}$  חדשים. מתוך כל הנאמר ומתוך עדויות אחרות ברור, כי מדת המשקעים השנתיים של הרי סיני גבוהה הרבה יותר מזו שרגילים ליחס לאזור הררי זה. וסמן לכך הוא בראש וראשונה הצומח הערבותי המכיל גם שרידים של עצים שאינם יכולים להתקיים בכמות משקעים מועטת מזו של 300 מ"מ.

## 5. הצומח

התעכבנו לעיל על בתי הגדול השונים מכיון שבהם קשורות יחידות הצומח השונות שנרשמו בשלושה החתכים הנ"ל. עלינו להדגיש כאן שנית, כי קביעתן של החברות האלו, וכן גם אפיון הפלוריסטי ארעיים למדי. את תפוצתן של יחידות הצומח לארך החתכים הננו מראים בטבלא מיוחדת: המכילה את שלושת החתכים<sup>(1)</sup>. ואלה הן יחידות הצומח העיקריות<sup>(2)</sup> (ראה עמוד 67):

### (א) חברות האפוניות לחמדה

- (1) חברת אנבסיס (יפרוק) מפריק (איג 1938). היא ידועה גם ממדבריות שכנים של א"י ומדבר סוריה מדת הכסוי היא זעומה מאד. אנו רשמנו אותה בחתך I (g, h, i, j) ובחתך II (b, h).
- (2) חברת אנבסיס-צלח. יתכן שאין זו אלא וריאנט של הקודמת. היא קשורה בעיקר לאפיקים המכוסים בחול גם. רשמנו אותה בחתך II (e f).
- (3) חברת אנבסיס-נואיה. אנו מצאנוה במישורי החמדה בכתמים שהיו מכוסים כסות דקה של חול. רשמנו אותה בחתך I (c, d, e).
- (4) חברת אנבסיס-דוחן אשון. מצאנוה במישורי החמדה בכתמים שהיו מכוסים שכבת חול עבה. בבית גדול זה מצאנו גם, פה ושם, אקסמפלרים מתים של נואיה, שרגליה נדחקו בלי ספק ע"י הדוחן עם התעבותה של שכבת החול. רשמנוה בחתך I (f).
- (5) חברת פרקרק השיח (1938 איג). בשעה שחברת אנבסיס מוגבלת בעיקר לחלק המזרחי צפוני של שטח חקירתנו, הרי חברה זאת קשורה אך ורק לחמדה שבחלק המזרחי של אותו השטח. בדרך כלל אנו מכירים את פרקרק

(1) ואלה הם הבאורים לטבלה זאת:

המספרים הערוכים בעמודה מאונכת הם מדות הגובה במטרים מעל לפני הים. הקו הגלוי העובר מעל לכל חתך הוא הקו המחבר את נקודות הגובה השונות של החתך. המספרים הנמצאים מעל לקוים המאונכים מסמנים את המרחק של כל נקודה מבאר שבע או מסואץ. האותיות שמתחת לקוים מסמנות את הקטעים השונים של החתך אשר הובדלו לפי הרכב הצומח שלהם. המספרים העבים שבכל קטע וקטע מסמנים את חברות הצמחים השונות המובאות ברשימה מיוחדת באותם המספרים. רשימה זאת סמוכה לטבלת החתכים.

המספרים שאינם בסוגרים מראים כי החברה הנדונה נפוצה או אופינית בתוך הקטע; המספר הכלוא בסוגרים מראה שלפחות בתוך הקטע החברה הנדונה מוגבלת מאד בתפוצתה או מקריה מאד.

(2) צמחים המובאים בתור דגמא להרכב החברה ימצא הקורא בטקסט האנגלי של העבודה



מזרח, בתוך אפיקים, בגדות נחלים ובקרבתם של מרוצי-מים בלתי מלוחים. רוב הקרקעות האלה תפוסים ע"י גדולי תרבות.

(ו) מלחות. אמנם יש במדבריות אלה גם מלחות בראשית, אך הללו מועטות הן. רוב המלחות נמנות על הטפוס ההידרומורפי. הללו נגרמות או ע"י הצפה או ע"י התרוממותו של אופק מי התהום. לסוג זה של מלחות שיכים בלי ספק כל שטחי המלחה שפגשנו בין סואץ וודי פירן ובסביבת המעינות של ביר חסנה, קוסימה וכו'.

(ז) בתי גדול מיוחדים הקשורים בסלעי היסוד שבדרום. כאן אנו רואים צמחיה וצומח מיוחדים וקשה לדעת מה יש ליחס לסלע הגרניטי של המקום ולתוצרת התרבותו ומה לאקלים המיוחד של המקום הקשור אל הגובה מעל לפני הים. הקרקע הנוצר כאן הוא קרקע חול גם, הממלא את אפיקיהם היבשים של הנחלים ואת השקעים שבין הסלעים.

(ח) אבן חול ניבית. אבן רכה זאת מתרוחת על נקלה לאדמת חול גם. טפוס זה של קרקע וסלע נפוץ מאד בסיני; אנו ראינוהו רק בקרבת ודי פירן.

#### 4. האקלים

חצי האי סיני נמנה על מדבריות היובש, בהם مدت המשקעים הוא הגורם המכריע בחיי צמחים. בתוך מדבריות היובש יש למנות את מדבר סיני עם המדבריות האוקיאניים (ים תיכוניים) בעלי 2 עונות שנה: עונת החורף (עונת המשקעים) הקצרה ועונת הקיץ (עונת היובש) הארוכה.

טבלאות על כמות המשקעים וחלוקתם בחדשים השונים וכן גם על הממוצעים החדשיים של הטמפרטורות מובאות בעמודים 63, 64 של העבודה הזאת; הללו נאספו באופן שטתי בעיקר בחלק הצפוני והצפוני-מזרחי של חצי האי. מהן אתה לומד שכמות המשקעים השנתית הולכת ויורדת מצפון לדרום. בשעה שבאל-עריש מגיע הממוצע ל-102 מ"מ, הרי באל-נכל אין הוא מגיע אלא ל-25 מ"מ ובסואץ ל-26 מ"מ בשנה.

מתוך המספרים האלה מתברר, כי יש לחשוב את כל החלק הצפוני, הבלתי הררי של מדבר סיני למדבר ממש, בגלל כמות משקעיו הדלה. ואם בכל זאת מרובים עוד כאן הצמחים וצורות הצומח, הרי זה בעיקר בגלל השקעים והאפיקים המשמשים אכסניה עיקרית לצמחים. צמחים אלה נהנים כאן מתוספת נכרת של משקעים, המגיעים אליהם בצורת מי גגר. כשקעים, כן משמשים גם החולות בית גדול מיוחד שלחותו מרובה באופן יחסי.

מתוך המספרים בטבלת הטמפרטורות אנו לומדים בין השאר שמדבר זה אינו חד-גוני גם מבחינה תרמית. בשעה שהממוצע של ינואר באל-נכל מגיע ל- $7.8^{\circ}\text{C}$ , הרי הוא מגיע בסואץ ל- $14.2^{\circ}\text{C}$ . אלה הם הבדלים תרמיים גדולים למדי ועל כן לא נתפלא על ההבדלים הגדולים המופיעים באופי הצומח שבין אזור אל-נכל וסואץ. למרות שמדת המשקעים שוה כמעט בשני האזורים הנ"ל. לעומת המחוזות הנ"ל של חצי האי, ידיעותינו על אקלימה של סיני ההררית הדרומית מועטות הן ומקורות מאד. על כן יש ליחס ערך רב לכל אינפורמציה הנשמעת מפי סיירים בכון זה. כך למשל אנו לומדים מפי בארון, יום, קאיור, רפא ואחרים על גשמי עזו ושלגים בחדשי החורף; כך מוסר למשל קאיור,

## 2. השטח שנחקר

שטחו של חצי האי סיני מגיע ל-60,000 ק"מ מרובעים בערך. אפשר לחלקו לשני אזורים: (א) אזור אֶרֶטִיָה (המכיל את רמת מדבר אֶרֶטִיָה ואת מדבר המיצר), (ב) אזור סיני גופא (המכיל בעיקר את החלק ההררי שבדרום). החלק הצפוני תפוס בעיקר ע"י דיונות, חמדה ורכסים של הרי גיר לא גבוהים, בשעה שהדרום מהווה בעיקר גוש של הרים גבוהים הבנויים אבני יסוד ואבן חול נובית, שגאות עמוקים מבתרים אותם. השיא הגבוה ביותר של הגוש הזה נמצא בג'בל קטרינה 2641 מ').

שטח החקירה בו עסקנו בנסיעה זאת מכיל כאמור שלושה חתכים. האחד עובר מעוג'ת אל-חפיר (גבול ארץ-ישראל-סיני) עד לאיסמאיליה. החתך השני מסואץ דרך ביר חסנה וקסימה עד לעוג'ת אל-חפיר. החתך השלישי נעשה מסואץ דרך אברונימה לדרום, דרך ודי מוכתב, וודי שיך עד לג'בל מוסה הוא הַר סִינִי.

## 3. הקרקעות

אם כי הגורם המכריע בחיי הצמח של מדבריות היובש הוא כמות המשקעים השנתית, יש בכל זאת לתכונות הקרקע תפקיד חשוב מאד בקביעת הרכבו ואופיו של כסות הצומח, שהרי בהן תלוי גראש וראשונה כח החזקה המים. מבין טפוזי הקרקע שפגשנו בדרכנו זאת יש להזכיר כאן:

(א) החמדה. אלה הם מישורים נרחבים שפניהם מכוסים כסות של חצץ. החמדה מהווה, כידוע, את הקרקע הטפוזי ביותר במדבריות של המזרח הקרוב, ובמדבר סיני היא תופסת שטחים עצומים ביחוד בצפון. כסות הצומח אינו מגיע עפ"ר בשטחים אלה אף ל-50%.

(ב) דיונות ועמקים בין הדיונות. בצפון משתרעים שטחי חולות גדולים מאד. בכלל עשיר יותר הצומח בשטחי החולות מאשר בשטחי החמדה. אך גם את קרקעות החול יש לחלק מבחינה אקולוגית לוריאנטים שונים, כמו למשל דיונות נודדות, דיונות נחות, עמקים בין הדיונות ושדות חול. העמקים שבין הדיונות הם, כמובן, עשירים ביותר בצומח, היות וכאן לא בלבד שאין הקרקע מופרע הרבה מבחינה מכנית ע"י הרוח, אלא שכאן הוא נהנה מלחות המסתננת מבסיסי הדיונות.

(ג) גבעות של אבני גיר. הדרכים בהן עברנו בתרו לא פעם בצפון את מערכת הגבעות של ג'ִדִי, יֶלֶג, הֵלֶל וכו'. אם כי מורדותיהם של גבעות אלה מכוסים סלעים וטרשים וביניהם ישנה רק כמות מועטה של אדמה גירנית-אפורה בכל זאת מצאנו כאן צומח עשיר בהשוואה לזה של המישורים הפתוחים.

(ד) קרקע לס. מעט מאד ידוע עוד על תפוצת הלס בסיני גופא. אולם עובדא היא שמרכז הגדול של הלס אשר בנגב הקרוב של הארץ קשור ע"י שלוחות לשטחי לס שבסיני הצפונית. בעיקר מתרכזו כאן הלס בעמקים שבין הגבעות. מקומות אלה המכוסים לס, אף על פי שמדבריים הם לגמרי מבחינה אקלימית (משקעים שנתיים של 50-100 מ"מ), הרי מראים הם מדה גדולה של פריון יחסי, המשתקף גם באפיו של צומח הבר.

(ה) קרקעות אלוביאליים. בעיקר מצויים קרקעות אלה בדרום ובדרום-



# עתוז לבוטניקה

חשון תש"ה

סדרת ירושלים

כרך ג' חוב' ב'

## חתכי רוחב בצומח של מדבר סיני

מאת מ. זהרי

### 1. מבוא

בעבודה זאת מובאים שלושה חתכי-רוחב בצומח של מדבר סיני, אשר נעשו באביב של שנת 1940 תוך סיור בוטני, בו השתתף המחבר יחד עם חברי המחלקה לבוטניקה של האוניברסיטה העברית, התחנה לחקר החקלאות ואחרים. מדבר סיני, על אף היותו בלתי נוח לחקירות בוטניות מפני חוסר דרכים וישובים, משך אליו בכל זאת, מפני קדושתו ומפני הענין ההיסטורי שלו, מספר גדול של חוקרים וחובבים, סיירים ואוספים, אשר תרמו הרבה להכרת הצמחיה של הארץ הזאת.

מבין החוקרים שבקרו את סיני נזכיר כאן רק את אהרנברג, המפריך, בוכה, שימפר, בואסיטה, פוסט, ברפי, הרט, קאיזר, קנויקר, רנגה וכן גם חוקרים אחדים של מצרים (שפתאי, דרר) וכו'. בגבול הצפוני-מזרחי של חצי האי (אל עריש) בקרו ב-1925 בין השאר גם א. איג והמחבר. מצב זה של חקירה פלוריסטית אפשר לכותב הטורים האלה לחבר ב-1935 בעזרת האוספים הבוטניים של מחלקתנו ובעיקר בעזרת הנתונים הספרותיים המרובים אנליזה פיטוגיאוגרפית של צמחית סיני (זהרי 1935).

לעומת התקדמותה של החקירה הפלוריסטית אין עוד שום ידיעה על יחידות הצומח של המדבר הזה. פה ושם אתה מוצא אמנם בספרות נתונים מקריים על שלטונו של צמח פלוני או אלמוני בסביבה, אך נתונים אלה אינם מבהירים במדה כל שהיא את האפי של צומח המדבר. בהתאם לכך חשבתי לנכון להביא כאן בקצור את תוצאות ההסתכלויות הגיאובוטניות של הסיור הנזכר לעיל.

לפני שאגש לעצם התאור של הצומח אעיר: (א) כי בסיור זה הצטמצמו רק לשלושה חתכי רוחב בלבד וברור שהללו אינם יכולים ללמד אלא על אזור הצר בו נעשו החתכים, (ב) כי חברות הצמחים המובאות כאן, הגם שחלק מהן ידוע כבר מארצות השכנות (1938 איג), לא נחקרו כאן אלא באפן פרלימינרי מפני המספר הקטן של התרשימים אשר נאסף בנסיעה זאת בשביל כל חברה וחברה.

# עתון לבוטניקה

מופיע בשתי סדרות

א. סדרת ירושלים:

יוצאת לאור ע"י חבר העובדים של המחלקה לבוטניקה באוניברסיטה העברית ירושלים.  
בכל שנה מופיעות 4 חוברות וכל חוברת נושאת עליה את תאריך הופעתה. כל כרך שנתי  
מכיל מ-300 עד 400 עמודים.

ב. סדרת רחובות:

יוצאת לאור ע"י ה. ר. אופנהימר וי. ריכרט של התחנה לחקר החקלאות, רחובות, א"י.  
בכל שנה מופיעות 2 חוברות וכל חוברת נושאת עליה את תאריך הופעתה. כל כרך שנתי  
מכיל מ-200 עד 250 עמודים.

במכתבים הנוגעים לענייני המערכת של סדרת ירושלים יש  
לפנות לד. ו. זיצקי, ת. ד. 620, ירושלים — ולענייני המערכת של סדרת רחובות  
לעורכי "עתון לבוטניקה" ת. ד. 15, רחובות.

את דמי החתימה יש לשלם למפרע ע"י שק או המחאת דואר לפי הכתובת: ההנהלה של  
העתון לבוטניקה ת. ד. 620 ירושלים. מחיר החתימה הוא:

2 000 לא"י לשנה, בעד שתי הסדרות

1.250 לא"י לשנה, בעד סדרת ירושלים בלבד

0.900 לא"י לשנה, בעד סדרת רחובות בלבד

בסכום זה נכללים גם דמי המשלוח.

במכתבים עסקיים, בכלל זה הודעה על שנוי כתובת, מודעות וכו' יש לפנות להנהלת  
העתון לבוטניקה ת. ד. 620, ירושלים.



# ע ת ו ז ל ב ו ט נ י ק ה

סדרת ירושלים

יוצא לאור על ידי

חבר העובדים של המחלקה לבוטניקה באוניברסיטה העברית

## ת כ ן

עמוד

יא	חכמי רוחב בצומח של מדבר סיני, מאת מ. זהרי . . . . .
	בדיקת המינים האורוגטליים של הסוג לוענית (Scrophularia) מתוך עשבת האוניברסיטה
יז	העברית, מאת א. איג . . . . .
יח	אצות כחוליות מארץ ישראל, מחקר על אצות ארץ-ישראל חלק א', מאת ט. רייס . . . . .
יח	מספר פטריות-שדפון חדשות לארץ-ישראל, מאת ט. רייס וא. צוירן . . . . .
יט	Rheum palaestinum Feinbr. sp. nov. מאת נעמי פינברון . . . . .

ירושלים